SCIENTIFIC AMERICAN

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THE JOHNSON PNEUMATIC TUBE.

The necessity for the transportation of high class freight, baggage, and mail matter at a more rapid rate of speed than is now possible on our railroads is conceded by all. The inventors of the day have been making many efforts to supply this want. It is felt that less than 25 hours should be consumed in sending mail matter to Chicago, and whatever we think of the possibility of dispatching passengers at so high a rate of speed, there seems to be no reason why freight and mail matter should not safely withstand the velocity of 100 or 200 miles an hour. We illustrate in the present issue an interesting effort in this direction, the Johnson pneumatic tube. Up to the present time it has only been tried on an experimental scale, and much work remains to be done to develop its possibilities, but enough has been shown to prove the practicability as well as possibility of economically imparting a high velocity to parcel carriers.

A tube is to be provided extending between the desired stations. Hollow balls or spheres packed with the objects to be transported are forced through this tube. A blast of air is forced into the tube, and the spheres are driven by the air pressure, the only practical resistance being rolling friction. Thus the minimum of resistance is offered.

The experimental tube which has been installed at Marion, N. J., is 1,000 feet long and 30 inches in diameter. It is constructed of No. 18 sheet steel, riveted up into a tight smooth tube and built in sections 25 feet long. Cast iron rings are fastened around it at intervals in order to strengthen and preserve its circular form.

Some of the spheres which are used in the trials of this installation are made of cast iron and others of sheet steel, the last being presumably the better material for actual practice. The tube being 30 inches in diameter internally, the external diameter of the sphere is 29 inches. If centered in the tube this allows a windage of one-half an inch all around it. The ball does not rest directly on the tube. Along the bottom of the tube a flat plate of steel, 4 inches wide and ⅜ of an inch thick, is secured. Upon this the sphere rolls, held up ⅜ of an inch from the bottom of the tube and therefore centered in it, giving an annular windage of approximately ½ an inch all around.

To drive the ball through the tube, a No. 5 Root blower, actuated by a 25 horse power engine, has been used. Hitherto for the experiments a partial vacuum has usually been used, a slight exhaustion ranging from one-half of a pound downward being produced and utilized for drawing the ball. It is proposed in practice to utilize both suction and pressure for this purpose.

In order to withdraw the ball from the tube, a Y branch, shown in our illustration, is provided. This branch is closed at its end. To withdraw the ball from the tube, a guide made of steel rods can be thrown over, extending obliquely across the main tube, so that as the ball comes toward the right, as shown in the drawing, it is diverted into the branch. The end of the main tube is made to ascend, and as it is closed it affords a perfect air cushion to arrest the progress of the ball. However fast the ball enters, it is brought quietly to rest by the air cushioning, and then gently rolls down toward the opening provided for its withdrawal at the end of the Y. At the other end of the tube simple gates are provided by which a ball can be rolled in and released at a given time.

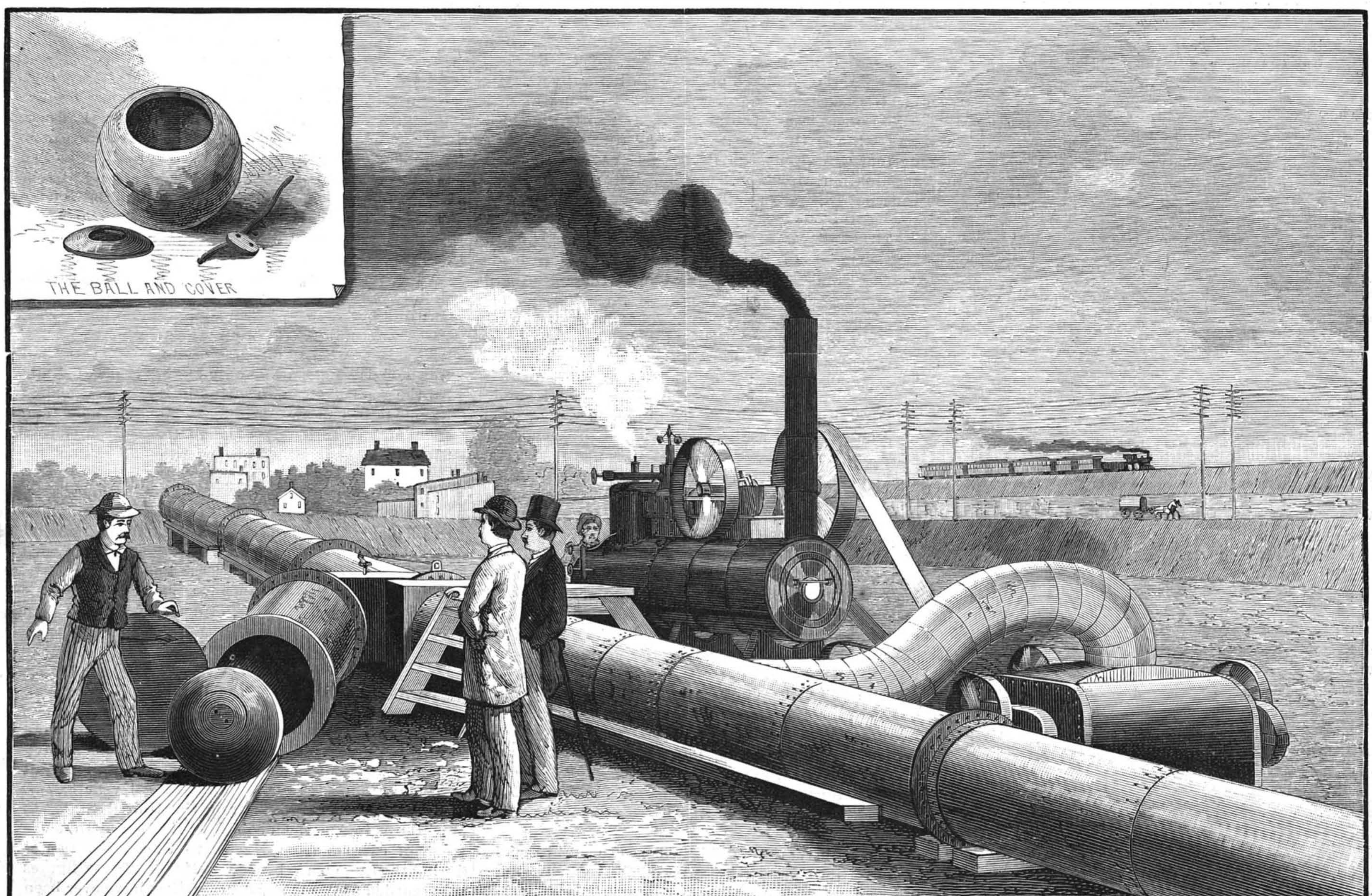
The results attained in practice have been very remarkable. Throughout the 1,000 feet of tube, balls have been propelled in 11 seconds. As they started from rest, the ultimate velocity attained, which has not been directly determined, must have been very high. In practice, it is believed, and claimed by the proprietors, that a speed of 300 miles an hour will be reached. The carriers which were experimented with weighed 750 pounds, so that it will be seen that the experiment was made upon an actual working scale. Owing to the principle of air cushioning, spheres could be made in practice to follow each other as closely as desired, as collision in the course of transit would be quite impossible. One interesting feature about the apparatus is that the ball is found never to touch the walls of the tube. Like a bicycle it preserves its equilibrium and always rolls upon the central bed plate or track. This fact has been ascertained by painting the balls; the paint showed no mark, so that it is certain that they never touch the sides of the tube. Again, when started to roll upon any given meridian or great circle, it is found that the sphere never leaves the track, but continues to roll upon it to the end of its course, it being understood that in such instances the track is elevated to one side of the tube, according to the degree of curvature, in order to prevent the carrier from impinging on the side of the tube.

Good Material the Best Economy.

That economy lies in the use of good material, and not in cheap stuff, says the *Master Mechanic*, was well illustrated on one of the large Ohio roads recently. The newly appointed superintendent of motive power found that the valve oil used on the road was a mixture of black oil and tallow, the total cost of which was 32 cents per gallon, and that the average mileage per quart was 100 miles.

He also found that one valve seat was being faced every day in the shops. A change was made to valve oil, costing 50 cents per gallon. This is giving an average mileage of over 200 miles per quart, and it has been necessary to face only five valve seats in four months.—*N. W. Mechanic.*

EVERYBODY SATISFIED.—Of the 55,000 exhibitors at the Paris exhibition, 33,000 get awards.



THE JOHNSON PNEUMATIC TUBE FOR THE QUICK TRANSPORTATION OF FREIGHT AND MAILS.

Scientific American.

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(Illustrated articles are marked with an asterisk.)

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SCIENTIFIC AMERICAN SUPPLEMENT

No. 720.

For the Week Ending October 19, 1889.

Price 10 cents. For sale by all newsdealers.

OPENING OF THE NEW LONDON BRIDGE.

The great bridge at New London, Conn., was formally opened on October 10. Special trains from New York and Boston brought large parties of invited guests to the scene. The assemblage was not only a large but also a thoroughly representative one, including many prominent engineers, state and railway officials, editors, and others. The bridge has already been described and illustrated in our columns (SCIENTIFIC AMERICAN, June 8, 1889). It is the largest drawbridge in the world. Flags were hoisted on the apices of the drawspan, furled up closely. In the presence of the two special trains and their passengers, one from the east, the other from the west, the draw slowly opened. The old ferryboat Groton, that for many years has carried the trains across the estuary, steamed through the draw by the eastern opening and returned. As she passed, a military band upon the draw played "Auld Lang Syne," an appropriate tribute to the change from old to new systems. The bridge closed, the bunting was loosed, and a salute of bombs was fired from the ice fender of the central pier. A collation and short excursion on the steamer Connecticut, followed by speeches, closed the occasion, that will long be remembered by those who participated in it.

The bridge will shorten the time between New York and Boston about half an hour, and will avoid many unforeseen detentions of the old ferryboat. Our thanks are due to the officers of the New York, New Haven and Hartford Railroad for courtesies received on this occasion.

THE ELECTRIC EXECUTION OF CRIMINALS.

The new law of the State of New York for the execution of criminals by electricity, instead of by the rope, will probably soon be enforced. Judge Day, before whom the evidence for and against the electrical system was presented, has decided the new law is constitutional. Mr. Harold Brown is the expert employed by the State to supervise the electrical machinery, and he has taken care to recommend the most effective and deadly means for the purpose, namely, the alternating current and the Westinghouse dynamo. This selection has given great offense in certain quarters, as it is supposed the machines named will have a stigma put upon them by reason of this debasing employment. Mr. Brown has been most unmercifully abused by some of the newspapers at the instigation, apparently, of the parties interested in the electrical machines. These persons pretend to be sufferers, both morally and commercially. They affect to be shocked that so pure and innocent an article as the alternating current should be used for such mean purposes; and, moreover, they think it will infallibly hurt their electrical business. Their often repeated unlawful killing of innocent people by means of their death wires running through the streets touches not their sensibilities, but the momentary pain to be inflicted upon a murderer by a lawful electric execution excites their liveliest sympathies.

So numerous are the accidents and so frequent the loss of life in this city from the overhead alternating current wires, that the mayor has expressed his determination to cause their immediate removal. This the companies are seeking to prevent by injunction.

THE INCANDESCENT ELECTRIC LAMP PATENT.

Some months ago, we noted the final hearing, before Justice Bradley, at Pittsburg, Pa., in the suit brought by the Consolidated Electric Light Company against the McKeesport Light Company, in which the validity of the Sawyer-Man patent of May 12, 1885, was involved. Suit was brought under this patent, and the complainants in affirming its validity strove for a broad interpretation of its claim, holding that it should cover the use in electric lamps of incandescing carbon conductors made of fibrous or textile substances. To this issue in the decision dated October 5, 1889, the Justice narrowed down the question. The patent was declared invalid. The decision holds that neither Sawyer and Man nor Edison can maintain any just claim to the use of charcoal generally in any form for such purpose.

Important as the decision is, as affecting the standing of a fundamental patent, the grounds on which it is based give it a special interest. The entire history of the application is reviewed in it. The patent was applied for January 9, 1880, and was put in interference with a patent applied for by Thomas A. Edison one month earlier. The interference was won by Sawyer and Man after years of contention in the Patent Office. During this period the application had been considerably changed by amendment. From the state of the art the conclusion expressed at the close of the preceding paragraph is reached by the judge. But independent of this he states that there are other reasons for his decision.

Edison's inventions, published to the world and introduced into practical use pending the interference proceedings, are considered at length. These developments the judge considers as of extreme importance. The use of a high resistance carbon, in place of one of low resistance, he believes to have been invented by Edison, and to have made the incandescent electric light a success. When Sawyer and Man made their application, he believes that they had no idea of broadly claiming the matter under contention in this suit, but that by amendments while the case was pending in the Patent Office they so broadened the scope of the patent as to meet and cover these inventions of Edison then going into public use. The decision holds that such expansion was unjustified by the original intention of the patentees. The treatment of this matter reminds one of the treatment of expanded reissues by the courts. It emphasizes the necessity of making the original application for an invention correctly. The ruling is strongly against essential modifications of applications for patents by amendments of description or claims.

The case will, it is presumed, go to the Supreme Court. Under this decision there would seem to be no fundamental patent right in high resistance carbon filaments made from fibrous material.

A Great Building for a Great Newspaper.

The corner stone of a large and magnificent building for the New York *World*, newspaper, was laid on the 10th of October with interesting and appropriate ceremonies. Several very able addresses were made, among the speakers being Mr. Chauncey Depew, Mr. Hill, Governor of the State, and others. Mr. Joseph Pulitzer, the editor and proprietor of the *World*, was unable to be present, owing to ill-health and absence from the country, but he sent a cablegram, which was read, expressive of lofty sentiments. Among other things he says:

"Let it ever be remembered this edifice owes its existence to the public; its architect is popular favor; its moral corner stone is love of Liberty and Justice; its every stone comes from the people and represents public approval for public services rendered.

"God forbid the vast army following the standard of *The World* should in this or future generations ever find it faithless to those ideas and moral principles to which alone it owes its life and without which I would rather have it perish."

The ceremony of bestowing the final touch to the corner stone was performed by the little son of the owner, aged four years, Joseph Pulitzer, Jr. If the boy lives to attain manhood, it looks now as if his inheritance would be a grand one.

The New York *World*, according to well authenticated statements, has a daily circulation of 345,000 copies—by far the largest of any daily newspaper in the world.

The new *World* building is located on Printing House Square, corner of Frankfort Street and Park Row, almost adjoining the entrance to the Brooklyn Bridge—one of the best business locations in the city.

The London and Northwestern.

At the lunch recently given to the American engineers by Mr. Webb he gave the following very interesting figures on the London & Northwestern Railway. The company, he said, had a capital in American money of $528,000,000, annual revenue $51,500,000, and an annual expenditure $26,500,000. The number of persons employed by the company was 60,000, and in the locomotive department 16,000; the miles operated were 2,500; there were 800 stations; 30,000 signal levers were in use; there were 13,500 lamps lighted every night; there were 1,400 cabins; the number of passengers carried annually was 57,000,000; weight of tickets issued, 50 tons; number of tons of goods and minerals carried, 36,000,000 annually; engine mileage per year, 55,525,334. In May last, with a mileage of 4,750,000, they had with these passenger trains only one hot crank pin, and with the goods trains two such failures; and they had only one failure of a connecting rod for both goods and passenger trains. The number of tons of water consumed was 20,000 per day; coal used, 2,700 tons per day; pounds of water evaporated per pound of coal used, 7·45. During the year, beyond the ordinary services, they had run 41,314 special passenger trains, 47,233 special goods trains, 78,285 special cattle and mineral trains; total, 166,832 trains. The company owned 53,000 wagons, 5,600 carriages, 3,200 horses, 3,100 carts, 2,500 engines, and 20 steamships. The Crewe engine works occupied 116 acres of ground, the covered area being 36 acres.

Progress of the Mexican Trade.

The Mexican *Economist*, the best authority on Mexican finance and statistics, gives some facts and figures regarding the condition of trade between Mexico and the United States which are regarded as rather startling, and which differ materially from those given out at Washington. It says that in the fiscal year 1887–88 the value of the exports from the United States to Mexico was in American coin $19,264,675, and that the value of exports from Mexico to the United States during the same period was $23,294,000. These figures are regarded as the most accurate that have ever been obtained, and show that exports from the United States to Mexico are several millions larger than heretofore stated by either Mexican or United States authority.

THE RAISIN INDUSTRY OF CALIFORNIA.

Fresno County, the geographical center of the fertile and extensive San Joaquin Valley, is the headquarters of this rapidly growing infant industry. The soil and climate prove so well adapted to the growth and curing of the fruit that the production has increased from 25,000 twenty-pound boxes, three years ago, to over 800,000 boxes the current year. New acreage has recently been added to such an extent that it is estimated the crop of 1890 will exceed two and one-half million boxes.

The muscatel, of Alexandria, and the muscat, of Gorda Blanca, are the two varieties grown. The average yield is three tons of fruit per acre, which is dried for ten days on trays in the vineyard, and hauled in large shallow boxes to packing houses at the railroad, and placed in sweating rooms to complete the curing process. They are then sorted by the nimble fingers of girls. The fine large bunches on the stems are selected for the first quality, and called London layers. These are worth $1.90 per box. The remainder are run through a large machine similar to a fanning mill, used by farmers for cleaning small grain. This detaches the scattering raisins from the stems, blows away the refuse, runs the fruit over screens and sorts it into two additional grades, called loose. Muscatels are worth from $1.40 to $1.75 per box of 20 lb., according to quality.

The farmer is paid from five to six cents per pound for the fruit in its roughly dried state. Three and one half pounds of green grapes make one pound of raisins.

At the present prices of fruit, the farmer receives an average of $175 net per acre. The gross receipts of one small vineyard of two acres, this year, was $780, out of which $100 was paid for labor.

The land is irrigated, the water being brought long distances, in canals, by water companies, and costs the farmer about $10 per acre per annum. So lucrative is the business, that it is attracting general attention. Large tracts are being subdivided into twenty acre lots, and sold at $100 per acre and upward, that three years ago could have been had for $10 per acre.

The combination requisite to success in the business, viz., a suitable soil, a prolonged hot and exceedingly dry atmosphere, bright, sunny days, and an abundance of water for irrigation, is here obtained to perfection, and the industry has received an impetus that threatens to absorb all the available land in Fresno, Tulare, and Merced Counties, an acreage exceeding that of New England.

An average of ten car loads of raisins are now going forward daily to the Eastern States from Fresno County alone.

[SPECIAL CORRESPONDENCE OF THE SCIENTIFIC AMERICAN.]

The Paris Exhibition.

PARIS, October 5, 1889.

I mentioned in a former letter that the sales of exhibited machines and articles had, in many cases, been remarkably great, and I now wish to give two examples of this, the first being that of S. L. Allen, of Philadelphia, Pa., who has sold about five hundred lawn mowers and about the same number of cultivators. This exhibit contains about half a dozen of the sample machines, and is almost covered with cards giving the names and addresses of purchasers. The next exhibit is the Excelsior and New Model lawn mower (Chadborn & Coldwell Manufacturing Company, Newburg), whose sales have also run into the hundreds. Valvoline is another American production that has made a great hit in the exhibition, and the fact meets you at every few steps in the machinery departments by notices to the effect that "This engine is lubricated with valvoline."

There is a very large collection of machine tools exhibited by the Ateliers Ducommun in a building outside the Palais des Machins and among the buildings devoted to the boiler exhibits.

I notice on one of the planers in this exhibit that the table has its slide gibbed on its edges instead of having vees on its bottom surface. Another feature peculiar to French practice, and one that is decidedly commendable, is that the beds of the planing machines are made considerably longer than the work table, an example in point being a planer table, say 2 feet 6 inches long, whose bed is about 20 inches longer. This no doubt steadies the table and prevents its deflection from overhanging work. A large planing machine in the same exhibit which has double heads on the one slide and side heads on the uprights has the table about five feet shorter than the bed, the latter being, if I remember rightly, about fourteen feet long. The slideways on this machine are gibbed and of the same shape as those for the small machine mentioned above. For this machine there are provided two extra beads, with revolving spindles for milling cutters, so that the machine is really a composite one, having all the motions necessary for a planing machine, while at the same time it may be utilized for milling work. As the pressure of the cut in the case of milling would (from the cutter or mill standing out of the horizontal) be in a direction to cast the work table or platen out of the slide ways if the latter were of the ordinary pattern, the reason for the gibbed table is obviously therefore to prevent this. There is in this same exhibit a gear cutter of the Gould & Eberhardt (Newark, N. J.) design and copies of the Brown & Sharpe grinding lathes.

In the galleries of the Palais des Machins there are some very interesting exhibits, the most notable of which is, as far as I have at present observed, a band sawing machine for cutting out patterns in textile goods. At the time I visited the machine the operator was cutting out patterns for bodices, and the goods were piled about two inches thick upon the table, and the saw cut them easily, cleanly, and quickly, leaving clean edges to the goods, which were of course fed by hand. As the operator was about leaving for the day, I was unable to obtain all the information upon the machine that I desired, but I will do so on another occasion, as I look upon this machine as one sure to find a wide application in the United States.

In the exhibit of the Paris-Orleans Railway in the galleries I find a long taper tap, about 1¼ inches in diameter, in which the tap has the usual form at each end, but along the middle and up to about 1½ inches from each end one tooth is cut out, so that only every other tooth cuts—a plan that undoubtedly reduces the friction, and therefore the labor of tapping.

Next to the railway exhibits in the galleries come the sewing machine exhibits, in which I find nothing of particular novelty. A great many of the machines have a pantograph motion for copying designs in embroidery. Attached to the pantograph is a frame on which the work is stretched, the operator feeding by means of moving the pantograph. In some few cases the spools of silk have either been dyed to suit the pattern or else the pattern has been made to suit the silk, because the silk is so dyed that it changes its color just at the right moment. Suppose, for example, a spray of roses is being embroidered, and the stem is begun with the silk being dyed the right color for the stem, then by the time the stem is done and the leaves are to be done, the silk will change to the necessary color for the leaves. This change of color is so arranged in the dyeing of the spool that various colored leaves and flowers can be embroidered without stopping the machine for a moment, the work going on steadily and continuously, although, of course, slowly as compared to ordinary sewing machine work.

The next exhibits are for leather cutting and boot and shoe making, in which I find nothing of sufficient note to warrant description.

A hand frame embroidering machine calls, perhaps, for some notice before leaving the galleries for the present. It consists of two rocking frames, say 14 feet long, and each carrying 25 needles. Between these frames is the work to be embroidered, say a border. The operators swing a rocking frame up to the work, through which the needles pass, and operators on the other side transfer the needles by hand from one frame to the other, changing the needles by hand to others having different colored silk or gold-covered silk, as the case may be. It looks a very slow process, but some of the designs are simply elegance itself.

We now come to the exhibits of diamond cutting, which is a very much rougher and more crude process than it is generally supposed to be. And while on this point let me say that Americans cannot be too careful in examining the cutting of any diamond purchased in either France or England, for a very great deal of it is simply abominable, as I purpose illustrating in a future article devoted entirely to diamond cutting.

A somewhat ridiculous thing is observed by many Americans in the United States general department, inasmuch as that Connecticut exhibits are placed under the caption of Tennessee, or may be Massachusetts exhibits under the heading of Texas. The names of the various States of the Union are painted on large panels along both sides of the section, but in allotting the space no attention appears to have been paid to these panels.

I took a party of friends to the Edison phonograph exhibit, and, to tell the truth, I felt considerably ashamed, for every instrument was using a roller with nothing but music on it, and not one was doing its work up to the mark, nor, indeed, anything like it; so much so that it was a positive damage to the reputation of the phonograph; and I advise those who want to get an idea of what this grand instrument can do to go to the exhibit in the United States general section, and not to the exhibit in the Palais des Machins. I hear that there is privately a good deal of friction between Edison and the European representative of the phonograph, on account of the way it has been managed in Europe, and the fact that Edison was said to be too ill to attend a grand reception given by Colonel Gouraud in London, but not too ill to visit the electric light installations in London, lends color to the above rumors.

The cast gearing in the Palais des Machins, to whose excellence I was the first to call attention, is, I find, being put forward as worthy of imitation in the United States, a step that would be a decidedly retrograde one, and that, unless for cheapness, will, I venture to say, never be taken in the United States.

To its advocates, I wish to say, if a gear wheel can be cast true enough, why cannot pulleys be cast true enough, and thus save the turning? I should like to see a shop fitted up with unturned pulleys; and the only difference is that the pulley shows its want of truth, whereas a gear wheel does not. It is quite true that even change wheels for lathes are sometimes cast, but what sort of threads will such a lathe cut? There is a good deal of difference between a fine casting and a good gear wheel, and it is a moral certainty that if we had instruments fine enough to measure and record it, we should find that the motion imparted to its shaft by a cast wheel of the very best workmanship is nothing more than a series of intermittent jumps. Is it not found that a drill will cut better and last longer if driven direct by a belt pulley than it will if driven by a gear wheel? And what reason is assigned for this other than that the pulley motion is more steady and even? For a mechanic to whom cast gears are good enough, or on a job for which it is good enough (as for a pug mill in a brickyard), well, it is good enough, for the man, or the job, as the case may be. It all depends on the standard one sets up. Some years ago George H. Corliss said to me, when speaking of the manufacture of the large gear wheel on his engine at the Centennial exhibition: "After they had divided off the index wheel for the cutting engine, I asked them (the men) if they could find any error in it, and was answered that they did not think they could, and the reply I made was for them to take another month and try." This wheel had a 3 inch pitch, ran at a speed of 38 miles an hour, and nothing more than a faint hum was heard from it.

I have seen (and pointed out in these letters) many excellent things in France and in the exhibition and many things that are otherwise. I have given a reason for every opinion, and generally a sketch in addition, hence your readers are in a position to judge for themselves as to the merits of each case.

The *guardiens* I find no longer attempt to prevent one from sketching in the exhibition, nor do the workmen object, nor is there any difficulty in that respect, probably because the principals of the exhibiting firms are present, and I have never found any difficulty with a principal, only with the underlings. Of course, if an exhibitor has something that he does not wish to be published or to expose, no one has a right to sketch it. Indeed, many very interesting things have been shown me under a promise not to explain them publicly or make sketches of them, and the same thing has often happened to me in my visits to workshops in the United States, and of course all such confidences are held inviolable. In the case of this exhibition, however, the objections have in almost every case come from officials who mistook their duty, and the sketches, objected to on the ground that I probably wanted to copy the articles sketched, were, in fact, made to show constructions neither novel nor worth copying. A further fact is that by taking a more complete examination, I need not have made these sketches, as they were in the nature of the merest memorandums. A sketch is of course more useful and attractive than simple talk, and conveys the idea better, while discussion is always advantageous—for the victor, as it shows he is right; for the vanquished, because it puts him right.

JOSHUA ROSE.

Brick Kilns.

Is the construction of kilns, as used by brick makers generally, not such as to require considerable attention to do reasonably fair work? Is the burning of all the up and down draught kilns not really a test of good luck? Does any brick burner say before his kiln is burnt that he positively knows what kind of a burn he is going to have? He tells us what he expects, if no unforeseen interferences occur, which in fact are always expected.

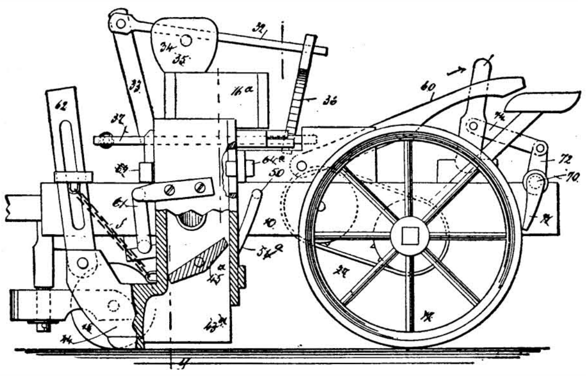
Why should the burning of brick depend upon so much knowledge and care, such as we hear from the old brick yard men is essential? Let us have a kiln that will simplify the labor of burning; a kiln that will automatically regulate the even distribution of heat and temperature. Let us have a kiln that any ordinary fireman can handle; a kiln that will only burn one even hardness and color, and do it at a large saving of fuel and labor; a kiln with an arrangement of test sights that any ordinary laborer can learn in ten minutes when the bricks are of the desired hardness and when to cease firing; a kiln in the fireroom of which we can hang up printed rules by which the firing is done according to schedule, and the results satisfactory, and not materially varying in its continuous output or operation.—*The Brickmaker.*

A Gigantic Tempering Bath.

The oil tank of the St. Chamond Works, on the Loire, France, is 72 feet deep, and contains 44,000 gallons of oil, which is kept in circulation by rotary pumps to prevent the oil from being unduly heated when masses of hot steel are plunged in to be tempered.

AN IMPROVED PLANTER.

The accompanying illustration represents, in side view, a planter for cereals, such as corn, which forms the subject of a patent issued to Mr. Arne S. Tragethon, of Kensett, Iowa. The machine is designed to effect the planting by means of a hand lever or through the medium of a driving wheel and proper connections. The main wheels of the machine have grooves in their peripheral faces, serving, as the machine advances, to cover the seed which has been deposited, a caster wheel forming the front support. In advance of

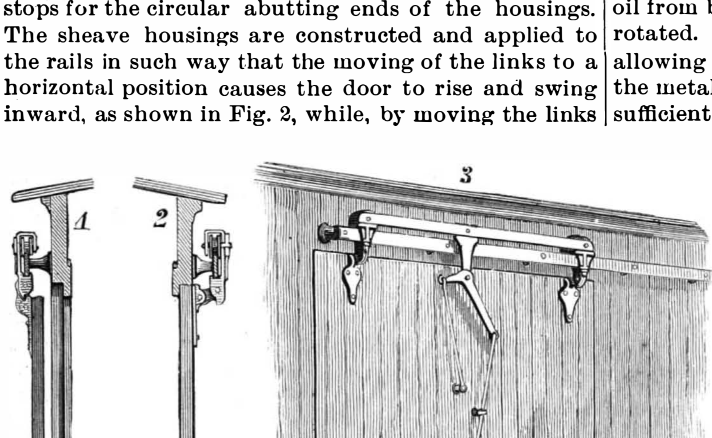


TRAGETHON'S PLANTER.

the main axle is a transverse shaft, operated by means of a sprocket wheel and chain from the main shaft, and on the transverse shaft are mounted cam-faced blocks, designed, by means of levers and rods, to operate slides which ride within the seed boxes or hoppers. The bottoms of the seed boxes are slotted, and the slides are transversely slotted to receive a charge of seed, the amount of seed received at each reciprocation of the slides being regulated by plates adjustably held within the slide recesses. As the slides are reciprocated their slots or openings are carried into register with apertures, whereby the charges of seed are delivered to conveyer chutes, which lead to other chutes arranged just to the rear of the furrow openers. Levers are pivotally connected to the side beams and extend up to within convenient reach of the driver, by means of which the depth of the furrows may be readily regulated, the furrows being opened as the machine is drawn forward and the seed deposited at stated intervals. When it is desired to drop the seed by hand, at such distance apart as may be required, this is effected by reciprocating a pivotally mounted lever. The machine entirely dispenses with the use of gearing, and is of light draught, and not liable to get out of order, while it may be run by unskilled labor.

AN IMPROVED FREIGHT CAR DOOR.

A freight car door which can be shut into its closed position flush with the outside surface or boarding of the car, and which can be swung out bodily and slid along guides and upon suspending rails to open it, is illustrated herewith, and has been patented by Mr. John H. McIntyre, of Rutland, Vt. Fig. 1 shows the door in section, swung out so that it can be moved along upon its supporting rails, Figs. 2 and 3 being sectional and perspective views of the door closed. A rail is secured to the car above the doorway to form a suspension track for the door to ride upon in opening and closing, and at the bottom of the door, at one side, is secured an iron having an L-shaped foot guide, to hold the door from swinging farther than is necessary away from the car. At the upper edge of the door are slotted hinge plates, to which suspension sheave housings are jointed by means of links and pivot pintles, the upper ends of the hinge plates being formed with a bevel bearing surface to form stops for the circular abutting ends of the housings. The sheave housings are constructed and applied to the rails in such way that the moving of the links to a horizontal position causes the door to rise and swing inward, as shown in Fig. 2, while, by moving the links to a vertical position, the door swings outward and downward, as shown in Fig. 1. To manipulate the door there is mounted on the rails a housing with sheaves or rollers, and with an elbow lever at its lower end, the short arm of this lever being connected to the door by means of a rod, while a sliding operating handle is pivotally connected to the long arm, this feature being shown in the perspective but not in the sectional views. By pushing upward on the handle connected to the long arm, the door is caused to swing outward and downward, and by pulling the handle down the door can be raised and swung inward, being guided also by a hand piece on the lower part of the door. The lock for this door is centrally fitted, and has a rocking arbor carrying a double crank or rocking bar, there being an operating lever fastened to the extended square end of the arbor, this lever having a curved perforated lug on its upper edge for entering the keeper lug and receiving through its perforation a fastening pin. A long bolt is connected on each side to the double crank or rocking bar, the bar causing these bolts to move in opposite directions and enter keepers in the jambs of the door casing.



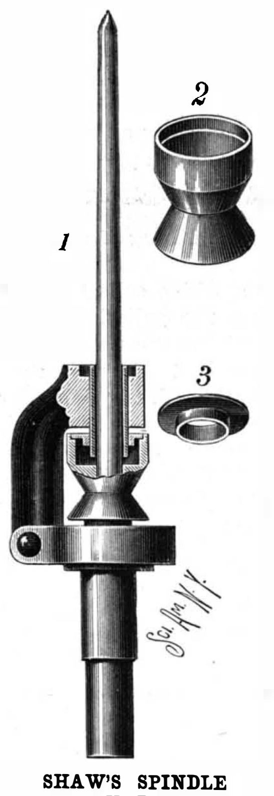
McINTYRE'S FREIGHT CAR DOOR.

Extension of Parcel and Money Order Postal Facilities.

In June last the Postmaster-General submitted to the Chilian minister the draught of a convention between the republic of Chili and the United States for the establishment of a parcels post system and a postal money order system between the two nations. Substantial advantages to both countries will result when the systems go into operation, which, it is hoped, will take place at an early day.

AN IMPROVED SPINDLE WHARVE.

A wharve so constructed that the oil will not be thrown out to damage the material on the spindle as the latter is revolved is illustrated herewith, and has been patented by Mr. James Shaw. Fig. 1 is a partial side elevation and vertical section of a spindle fitted with this wharve, which is shown separately in Fig. 2, the wharve cover being represented in Fig. 3. The spindle is held to revolve in a frame, projected from the top portion of which is a sleeve, the upper face of which is recessed, and its bore provided with a metal packing thimble in which the spindle revolves, the thimble extending downward into the wharve. The spindle and wharve are rigidly attached to each other, and the upper section of the wharve is hollowed out to form a chamber capable of containing quite a quantity of oil. In the inner wall of this chamber near its upper end is an annular recess forming a shoulder adapted to sustain the periphery of the ring-like cover shown in Fig. 3. This cover is brazed or otherwise rigidly secured to the wharve, and its flange acts to prevent the oil from being thrown out when the wharve is rapidly rotated. The oil chamber of the wharve is filled by allowing the oil to pass down between the spindle and the metal packing thimble. As the spindle is revolved, sufficient oil for its lubrication is drawn upward in the thimble by reason of the rapid movement of the wharve, the oil falling down again into its compartment when the spindle is stopped, it being impossible, no matter how rapidly the wharve may be revolved, for any of the oil to be drawn out upon the silk or other material carried by the spindle.

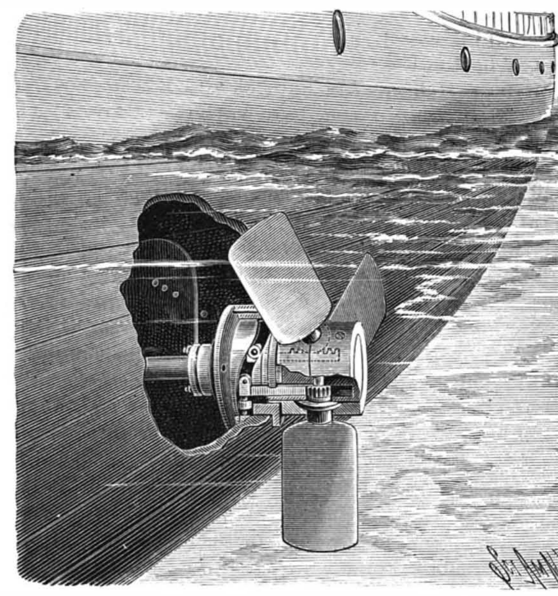


SHAW'S SPINDLE WHARVE.

For further information relative to this invention address Messrs. Taylor & Co., Paterson, N. J.

AN IMPROVED FEATHERING PADDLE WHEEL.

The accompanying illustration represents the employment of a submerged propeller, the flat surfaces of the blades of which, as the propeller is revolved, will be at right angles to the line of travel when the blades are in position to force the vessel ahead, while their side faces are turned parallel with the line of travel when the blades would otherwise act to retard the onward progress of the vessel. This invention has been patented by Mr. John Williamson, of No. 300 Hooper St., Brooklyn, N. Y. The view is taken about amidships, looking toward the stern of the vessel, and parts of the propeller are broken away to disclose its interior construction. The driving shaft extends outward through the side of the vessel through a packing or stuffing box, and through cam-faced flange plates bolted together to form a cam groove around the shaft. To the extended end of the shaft there is



WILLIAMSON'S FEATHERING PADDLE WHEEL.

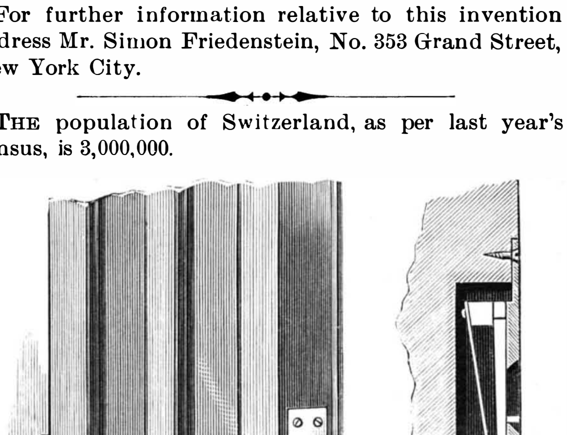
keyed a hub formed with radial apertures adapted to receive the inner ends of blade-carrying hubs, the latter formed with flanges which overlap flattened sections on the hub keyed to the driving shaft. To the blade-carrying hubs are connected gears engaged by racks housed within recesses formed in the hub keyed on the driving shaft, the inner ends of the racks carrying brackets which serve as supports for anti-friction rolls which ride in the cam groove around the shaft, and for other anti-friction rolls that ride upon the peripheral face of the shaft. With this construction, as the driving shaft is revolved, and with it the outer hub and its blades, the anti-friction rolls riding in the cam groove alternately turn the faces of the paddles into and out of position to present a resisting surface to the water.

AN IMPROVED DOOR BOLT.

The accompanying illustration represents a door bolt patented by Messrs. Louis Schoen and Simon Friedenstein, of New York City, in which the bolt is designed to engage with a socket in the door sill, the socket having a spring-operated plug or follower to fill its opening when the bolt is lifted, and thus prevent the filling of the opening with dirt, snow, ice, etc. The lower corner of the door is faced with an angle plate, inclosing a space in which the bolt is vertically held, this plate having near its upper end a guide lug, to which is secured a spring catch adapted to engage with a notch at the back of the bolt, to hold the bolt when thrust down into the socket in the sill, as shown in the sectional view. This spring catch may be disengaged by a push button, the stem of which reaches through a slot in the bolt and connects with the lower end of the catch, the spring in the socket in the sill then forcing the bolt upward and unlocking the door, the pressure of the spring catch upon the inner face of the bolt then serving to retain it in elevated position. To lock the door the bolt is forced down by means of a finger piece fastened to the bolt and projecting through a slot in the angle plate.

For further information relative to this invention address Mr. Simon Friedenstein, No. 353 Grand Street, New York City.

THE population of Switzerland, as per last year's census, is 3,000,000.



SCHOEN AND FRIEDENSTEIN'S DOOR BOLT.

Uranium.

Exactly a century ago—namely 1789—Klaproth succeeded (says the London *Times*) in isolating from a dark-colored mineral, know as pitchblende, a yellow oxide, which, after carefully testing, he pronounced to be the oxide of a new metal. To this metallic substance he gave the name of uranium, so calling it after the planet Uranus, then recently discovered by Herschel, and it was at once classed among the rare metals, and still remains so. It rarity is indicated by its market price, which is about $12,000 per ton, or $6 per lb. There are several oxides of this metal; but the best known and most important is the sesquioxide, which forms a number of beautiful yellow salts. This oxide is largely employed for imparting delicate golden and greenish yellow tints to glass, while the protoxide is much used in producing the costly black porcelain. Uranium is also found to be useful in certain photographic processes as a substitute for the chloride of gold; but its rarity and consequent high price have hitherto caused its application to be very limited, though there are uses other than those already named to which it could be put if it were less scarce and less costly. It is found in Cornwall, Saxony, and Bohemia; but up to the present time it has only been met with in isolated pockets and patches. The centenary of its discovery by Klaproth has, however, been marked by the finding of a continuous lode at the Union Mine, Grampound Road, Cornwall, which is believed to be the only known lode in the world. This discovery is regarded as unique in the history of the metal, for the lode is what is known as a true fissure vein, and the ore is found to contain an average of 12 per cent of the pure metal, the assays going up as high as 30 per cent in some parts of the lode. Several tons of the ore have already been raised and sold, fetching high prices. The lode traverses the mine from north to south, and the uranium occurs in it chiefly as a sesquioxide. It is anticipated that the present discovery will enable two important applications of the metal to be followed up. The first is as a substitute for gold in electroplated ware, inasmuch as with platinum and copper it forms two beautiful alloys, each having the appearance of gold, and the former also resisting the action of acids. The second application is in connection with electric installations, where its usefulness consists in its high electrical resistance. The mineral deposits generally at the Union Mine are of an exceptional character, comprising, in addition to uranium, magnetic iron, silver, lead, tin, copper, ocher, and umber.

Trial of a New Signal.

Reginald Heber Earle, an inventor of St. Johns, N. F., recently gave a test exhibition of a marine distress signal invented by him, in the river in front of the barge office pier, this city. The apparatus consists of an oblong cylindrical shell of tin charged for about one-fourth of its length with a service charge of two and one-half pounds of powder. Above the powder was an air chamber to give buoyancy to the shell, and through this ran two small tubes containing fuse which connected with the bottom and the top of the charge of powder. These tubes then came together at the top of the shell in a tube filled with fulminate of mercury, over which was screwed a cap.

The object of the shell is to take the place of all distress signals now used in marine signaling, such as rockets and firing of minute guns, in doing which much valuable time is lost. It is intended that the Earle marine distress shell, as the contrivance is called, shall be distributed about a ship, but particularly kept on the bridge within easy reach of the captain. When he desires to give a signal of distress, instead of losing time to load and fire a cannon or touch off a rocket, he seizes an Earle shell, pulls the cap off the detonator, scratches the fulminate with the rough edge of the cap, and throws the shell overboard. In twenty-five seconds there is an explosion, and a loud, booming report is heard, while a column of water, flame, and smoke shoots for at least 100 feet up in the air. An extra appliance of a rocket is attached to the shell used at night, and this is thrown to a great height by the explosion, and itself explodes in the air.

The tin cylinders of the shells then float about on the water, and as they have the name of the ship stamped on them, they serve in time of disaster to tell of the loss of the ship they came from.

At the trial Mr. Earle took a boat and went about half way between the barge office pier and Governor's Island. Two shells were thrown overboard, and after dancing on the water for a moment they exploded with a tremendous report and threw a column of smoke and water into the air to a great height. The column of smoke and water was seen all over the bay, and the noise proceeding from the explosion must have been heard for miles. The *Times* says, as soon as the first shell exploded, the air was rent with the screech of steam whistles from every tugboat and steamboat in sight. Crowds of people who were strolling through Battery Park instantly rushed to the sea wall, attracted by the strange sight of the smoke shooting up from the bottom of the bay. Mr. Earle is to exhibit his invention before the International Maritime Congress, the United States Navy Department, and the International American Congress about to convene at Washington.

WILLIAM B. DUNNING.

The subject of the accompanying illustration, the president of the village of Geneva, N. Y., and engaged in extensive manufacturing interests there, was born in Cayuga County, N. Y., in 1818. He lived in Auburn until his fifteenth year, when he went to Dunkirk, N. Y., to learn the trade of an engineer and machinist, for which purpose he was "bound out" under bonds of $500 to serve four years and two months' time. His wages were, besides board and washing, $40 for the first year, $45 for the second year, $50 for the third year, and $60 for the fourth year—a length of service and a rate of compensation which would be thought pretty severe, at the present time, by most boys desiring to acquire trades. In 1841 Mr. Dunning commenced work in Geneva, N. Y., his wages being nine dollars a week, he being then the only machinist in the place. Shortly afterward he entered the employ of the owner of the Seneca Lake steamers and the Seneca Lake Foundry and Engine Works, and began building engines and boilers for vessels, as well as stationary engines. In 1853 he built the New York Central Iron Works, at Geneva, N. Y., which were burned in 1870 and rebuilt the same year, and of which he has from the first been the proprietor. At an early period Mr. Dunning patented and brought out a practical steam-heating boiler, to which he has since added many improvements, and of which many thousands are now in successful operation. Mr. Dunning has been a village officer since 1867, and is still the active overseer of the business carried on in the several departments of his extensive works.

Wm. B. Dunning.

How to Extend Our Foreign Trade.

A correspondent of *Boots and Shoes* says: I have been much interested in the matter of exports of manufactured goods for years past, and have striven in every way to ascertain if possible the cause of their being so light. I am convinced that the one great cause is lack of transportation facilities. The buyer of to-day, whether in Buenos Ayres or Chicago, wants his purchases delivered promptly and with regularity. That we are not provided with regular direct communication with South America is the fault of our general government.

If heavy freight is to be sent to South America quickly and cheaply, it must be shipped to some English or German port and then reshipped to port of destination

Some of the largest manufacturers of boots and shoes in Europe devote exclusive attention to the production of goods for the South American markets. The proprietor of one located in Switzerland has for many years made an annual visit to this country. His factory is stocked with American machinery, he cuts large quantities of American sole leather and has, so far as possible, adopted American methods of working. He has investigated the cost carefully, and he stated to the writer that it cost as much to produce most kinds of shoes in his country as it does like kinds in America. Said he: "If transportation was as direct, regular, and cheap between New York and South American ports as it is between German ports and South America, I could afford to remove my factory to America."

What a sorry comment it is on our enterprise as a nation that we make the sole leather from South American hides, sell it to European manufacturers, to be made up into shoes for the people who gather the hides, we having no share in the manufacturing profits, except on the leather, and none on the transportation profits. Other nations encourage commerce by a judicious system of subsidies.

As a nation we are now so situated that we can manufacture in competition with other nations. What we need is means for transporting our products as cheaply as they to the various markets. These may be secured if manufacturers and workmen will make a united effort to secure the necessary legislation.

Much is said of the benefits likely to arise from the grand international exhibition in 1892. If steps are taken between now and that time to increase our commercial marine, and the establishment of rapid and regular steam communication with those countries likely to be buyers, then the exposition will benefit our manufacturers by increasing the export trade, but if nothing is done in that direction, the exhibition will be no benefit to our export trade.

Baldwin Compound Locomotives.

We learn from a reliable source that the Baldwin Locomotive Works, Philadelphia, are constructing a locomotive that will embody the compound principle of the English locomotive that the Pennsylvania Railroad Company has been testing on its different divisions during the past six months. The officials of the road have been very well satisfied with the performance of this engine, especially on the New York division. The form of this engine has been found to be unsuitable for railroad lines in this country, being too rigid; but, of course, it is not the intention of our railroad managers to substitute the clumsy, uncomfortable English engine for the well-proportioned and graceful American locomotive. The English engine has a single front wheel on each side instead of the two customary on American locomotives. The driving wheels look very much like those used on the ordinary American locomotive, but they are operated in quite a different manner. Each set of wheels is independent of the other, instead of the two pairs being linked together by bars. The rear pair of wheels is connected with a cylinder similar to that of the American engines, but placed lower down and between the front truck and the front driver. There are two cylinders, one on each side. Between these two and underneath the boiler is a third cylinder, the rod from which connects with a crank in the axle of the front drivers. The steam from the boiler goes first to the pair of cylinders connected with the rear drivers, when, instead of passing off into the open air, as in the ordinary American locomotive, it is turned into the third cylinder, where the rest of its force is exerted upon the front drivers. This double use of steam is the main feature of the English locomotive, and it is to demonstrate the value of this principle that the present experiments are being made. The final test of this engine will be made under the direction of the general superintendent of motive power, from Altoona, and will consist of complete and exhaustive experiments to determine just the amount of coal, water, oil, labor, and other things necessary to obtain a certain amount of power from the new locomotive. If these experiments prove, what is generally believed by engineers now, that the compound type will produce considerably more power at less cost than the style of engines at present in use, then the compound system will be adopted at once by the Pennsylvania Railroad Company and applied to all its locomotives as rapidly as possible, as the change would involve no serious alteration in the American locomotive.—*Iron.*

THE total number of miles of railroads in the United States at the close of 1888 was 156,082, of which 7,028 miles were built during the year.

The number of locomotives in service was 29,398; passenger cars, 28,252; freight cars, 1,005,116. This is an increase during the year of 1,548 locomotives, 1,388 passenger cars, and 48,485 freight cars. In the Dominion of Canada there are reported to be 12,701 miles in operation, on which there are 1,657 locomotives, 1,912 passenger cars, and 44,009 freight cars.

Let Your Mind Aid Your Hands.

At the present time there are too many who endeavor to be successful, or in other words who get their living, by "main strength and ignorance." This is a direct result of the neglect of a proper education in early life. In some cases physical exertion may be necessary to the accomplishment of the end sought, but in nine cases out of ten this is a simple waste of strength through the neglect of mental training, and reminds one of the philosophy of the proverbial son of Erin, who while not lacking in wit is not witty, for he will invariably attempt to make his muscle do what his mind ought to do, or at least what it ought to assist in doing.

Good judgment is oftentimes more valuable than years of experience. Some workmen will not put the least bit of calculation into a piece of work, and they might work on for years, putting out all their physical energy upon the work, never for a moment doubting that that is the only means of accomplishing it.

But turn to the proverbial Yankee, who is not particularly fond of exerting himself physically, and who generally contrives to make his mind save his body, and quite a difference is noticed. Instead of hammering, straining, and doing the work himself, he deliberately sits down to "figure out" some device for accomplishing the same result. If a difficult task presents itself, where apparently considerable muscle is required, he looks the thing over, and generally contrives some means of doing it without "putting his shoulder to the wheel." In other words, he lets his mind help his hands.

Here is just where the intelligent and thoughtful workman has the advantage of the illiterate and ignorant, and is the reason why we find so many really good workmen, so far as physical force is concerned, plodding along, earning barely enough to support themselves.

What American workmen need is to cultivate their minds, and equalize the labor between the mind and body, resulting in a more perfect condition of both, and rendering their services more skillful and themselves more valuable workmen.

Let your mind help your hands, and you will find your work easier, your life happier, and your condition generally much improved.—*The Practical Mechanic, Worcester, Mass.*

The Treasures of the Deep.

During the dredging operations now going on in the port of Santander, Spain, the well-preserved remains of a war ship were encountered at the entrance to the harbor, partly buried in sand and mud, which must have gone down in that spot four centuries ago. As the dredgers could not remove the old hull, the Spanish government ordered it to be blown up, and to employ divers for saving what could be saved. The work has turned out a very profitable one, and great care is consequently displayed. The vessel dates probably from the end of the fifteenth or the beginning of the sixteenth century. Guns and other equipments raised show the united coats-of-arms of Castille and Arragon, and some bear the scroll of Isabella la Catolica, others the crowned F of Ferdinand the Catholic. As among the numerous arms found on board there are many of Italian or French origin, and the vessel appears to have served as a transport, it is generally supposed that she belonged to the expedition of Gonzalo de Cordoba against Naples, and that she foundered on her return from Italy, laden with trophies and plunder, on entering the port of Santander. This surmise is supported by the fact that, among the coin saved, there are, besides Spanish coinage of the time of the Catholic kings, numerous coins with the head of Charles VIII. of France and the various Italian states of the time. Since the discovery was made, the diving and saving operations are carried on with great energy, as it is hoped to meet with valuable finds from an expedition which was particularly rich in plunder.—*Iron.*

Articles Found in Cotton Bales.

According to the Providence *Journal*, at the Wampanoag Mill not long ago, the workmen in the picker room stopped a package of matches just as the bundle was disappearing into the picker. It had come out of a cotton bale the men had just opened. Had they gone into the machine, there would have been a lively blaze. Speaking of this incident, a man who has tended a picker for several years said that the things which come out of a cotton bale and evidently grow on bushes would astonish one. One day he heard something grind inside the picker, and, stopping the machine, found a silver spoon. Lizards and small snakes were common. A set of false teeth, small coins, knives, tobacco, and occasionally articles of more value have been found. These things undoubtedly get inside the bales accidentally, but there are other things which evidently get inside in accordance with a fixed purpose, and by strange coincidences they are found to weigh more than cotton, and not to be worth as much per pound on the market. Sand, scrap iron, and dirt are often found wrapped inside of a cotton bale for ballast.

How to Promote Commerce.

At the recent banquet of the Spanish-American Commercial Union, in this city, the Hon. W. Eleroy Curtis spoke very strongly in favor of promoting American commerce by granting liberal pay to American ocean mail steamers. Among other things he said:

"The cry of 'subsidy' has frightened Congress. But, Mr. Chairman, the United States is one of the most liberal nations on earth in giving subsidies. I intend no sarcasm. A subsidy, as we understand it, is pecuniary assistance to facilitate commerce, and our Congress offers it to almost everything but ships. We subsidize the sheep of Ohio and the sugar cane of the South, the iron of Pennsylvania and the lumber of Michigan. Every railroad is subsidized, every stage coach, and every steamboat that plies our inland waters or skirts our coast.

"Every town in which a post office is established or a government building erected is subsidized at the expense of the tax payers for the convenience of commerce, but when it comes to ocean mails the practice stops. Every commercial nation but our own assists its ocean steamers, and the experience of ages has taught that it is the only way to establish lines of foreign trade.

"Why, Mr. Chairman, America was discovered from the deck of a subsidized ship. (Laughter and applause.) A woman left her jewels with a banker at Seville to secure its payment, and a clerk in the counting room of that banker, perhaps the very one who counted out the gold, afterward gave his name to this hemisphere. England secured her commercial supremacy by subsidy. Nor has she given her service to the lowest bidder, but to the best, and in long contracts, so that the ship owners might know what to depend upon in the future. Some years ago an attempt was made by a rival line to get the mails away from the Cunarders by underbidding. But that British postmaster-general whose eyes were sightless, but who saw with his mind much that other men overlooked, said 'No.' The Cunarders had done the service satisfactorily for half a century, he said, and had built a fleet of stanch and swift ships with the expectation of a continuance, and they should keep the contract. The same policy was pursued in reference to the Royal Mail Company, whose vessels carry the mails of England to the West Indies and South American ports. The attempt of a rival company to underbid them was rebuked.

"But we don't do things that way in the United States.

"American steamships will never be fairly paid until their compensation is reckoned by the length of the voyage, instead of the number of letters carried, and we will have few steamers until contracts are made for more than a single year. When the rates of foreign postage were reduced under the treaty of Berne—under the International Postal Union—no one intended that the reduction should be made at the expense of the steamship owners. The interstate commerce law prohibits the railroad owners from charging as much for a short haul as for a long haul, and the compensation given to the stage coaches in the West is measured by the distance they travel and the cost of the trips. The ocean service is the only branch of our postal system that is self-supporting, and Mr. Vilas confessed that he had to pay to the boats on the rivers of the South excessive compensation in order to provide the planters with facilities for reaching market.

"Is there any greater wrong in affording the merchants of New York facilities for transportation to the South American ports than in furnishing the same to the merchants of Evansville, Ind., or the planters of the Chattahoochie, or the market gardeners along the Chesapeake, or the summer visitors of Buzzard's Bay and Bar Harbor? Let me cite a few illustrations. During the last year the Post Office Department paid $44,500 for the transportation of mails on the rivers of Arkansas, and only $13,715 for the transportation of mails to Japan; $54,701 on the rivers of Washington Territory, and only $42,593 to all the Asiatic and Australian ports. We paid $79,637 for carrying the mails on the rivers of Florida, but only $47,997 for sending them to all Central and South America and to the entire West Indies, with the exception of Havana. We paid $20,979 on the Ohio River between Paducah and Louisville, $101,566 in subsidized stage coaches in Nevada, $239,568 in Washington Territory, $163,893 in Idaho, and $417,000 in Colorado, and but $86,890 to encourage American steamers all over the world.

"During the summer season of 1888, in order that the good people who go to Nantucket and Martha's Vineyard might get their letters regularly, the government of the United States paid a subsidy amounting to $12,093. This for five months. During the same time it paid $4,885, a little more than one-third as much, to build up a trade with Brazil. The little steamboat on the Androscoggin Lake would have received a third more than the Red D line to Venezuela had it been kept going the entire year, but it stopped when the summer boarders went home, and was satisfied with a subsidy of $3,700 for four months, while the Venezuela line got $6,000 for twelve months.

"The excursion boat that plies between Watkins Glen and Geneva, N. Y., got twice as much in 1884 as the Venezuela steamers, and the ferry between Norfolk and Cape Charles got as much last year. The steamers of the Chesapeake Bay and its tributaries got $49,539 annually, or more than is paid to all the Central and South American lines, while the boat between Norfolk and Baltimore got $13,518, or $2,000 more than the line to Brazil. The coastwise steamers got $563,000 last year for less than 500,000 miles traveled, which is more than $1 a mile, while the steamers to South America and the West Indies traveled more than 2,000,000 miles and got less than $48,000—2 cents and 4 mills a mile.

"Previous to 1885 the Havana mails were included in the foreign service and cost $7,134. That year they were transferred to what is called the Star Route service, and $58,339 is now paid to the little steamer that carries them from Tampa to Havana. This is just $214 less than is paid by the United States government to the ships of all nations to carry mails to all the parts of this hemisphere. (Laughter and applause.) This little steamer Mascotte, Mr. Chairman—and she seems to be well named—for a voyage of but 188 miles receives two-thirds as much money annually as is paid to all the ocean steamers of this wide, wide world. It is the most ($86,890, $58,339) extraordinary phenomenon in the commercial history of this or any nation. Were these same terms offered to ocean steamers, the Stars and Stripes would not be so rare a sight in the harbors of other lands, and it is only by such encouragement from our government that we can build up a foreign trade." (Loud applause.)

Dipsomania, or Thirst-madness.

The periodical desire for strong drink which sometimes besets individuals, otherwise moral and exemplary, is a species of paroxysmal mania beyond the control of the patient. It is quite certain that there are thousands of cases of *remittent drunkenness*, which presents the specific symptoms of disease. The periodical drunkard is not an habitual dram drinker. But at particular times he appears to be attacked with a *thirst-madness* which deprives him of the power of volition, and hurries him into the most terrible excesses. During the interval between the paroxysms, he may be a perfectly sober man.

For many weeks, or even months, he may have steadily refused to taste a drop of liquor; may indeed have felt no inclination for it, but on the contrary regarded it with disgust. And yet, when the fit comes on, the raging thirst for alcohol utterly paralyzes his conscience and his will. A man in this condition is a monomaniac, and should be treated as one. If put under proper restraint at the commencement of this *furor*, the dipsomaniac, in nine cases out of ten, might be tided over his difficulty in the course of a week, and a perseverance in the course at the recurrence of the hallucination would probably eventuate in a complete cure. It is not easy to persuade the world that all drunkenness is not voluntary. The law does not recognize dipsomania. It treats all inebriates alike. This seems to be unjust, though it is hard to say where the line should be drawn between free-will excess and that which proceeds from an uncontrollable mania.—*Munford's Magazine.*

The American Engineers' European Trip.

"One of them," in communicating his impressions and reminiscences of the trip to Europe to the *Engineering and Mining Journal*, is satisfied with its results, which include: "Five pounds increase in weight, stronger nerves, better digestion, had a good time for two months, gained some knowledge, had some Yankee conceit knocked out of me, yet became prouder than ever of my American citizenship and of the engineering profession; met many distinguished men, saw many wonderful works, and had so many delightful experiences that the memory of them will be a life-long pleasure." Consequently, although the trip cost him $500, it paid. Moreover, it must be a source of great satisfaction to him, the editor of *Iron* adds, to find that he can now get his hat on his head without the aid of a shoe-horn, suffering not in the least with the "swelled head" which stay-at-homes thought those who went abroad were afflicted with. His head being now reduced to normal size, there remain in it some memories of the trip, which he communicates to the readers of our American contemporary.

Other Senses than Ours.

The president of the British Association, Prof. Flower, indorses Sir John Lubbock's idea that the field of inquiry is limitless, and that there may be "fifty other senses as different from ours as sound is from sight; and even within the boundaries of our own senses there may be endless sounds which we cannot hear, and colors as different as red from green of which we have no conception. These and a thousand other questions remain for solution. The familiar world which surrounds us may be a totally different place to other animals. To them it may be full of music which we cannot hear, of color which we cannot see, of sensations which we cannot conceive."

The Iron and Steel Institute in Paris.

The autumn meeting of the Iron and Steel Institute was held at Paris on September 24. The meeting place was the hall of the Societe d'Encouragement pour l'Industrie Nationale, in the Rue de Rennes. The proceedings commenced by a few words of welcome from M. Gustave Eiffel and M. Haton de la Goupilliere, presidents of the Societe des Ingenieurs Civils and the Societe d'Encouragement respectively. The presentation of the medal awarded to M. Henri Schneider could not be carried out at the meeting, owing to the unavoidable absence of M. Schneider, and it had therefore been arranged that the presentation should be made later by Sir Lowthian Bell at Creusot, in the presence of the workmen.

In a short opening address, the president referred to the genius of the French constructors in iron, which was most brilliantly illustrated by the Eiffel tower, as were the services of their scientists by the development of the open hearth furnace from the first trials at Montlucon and Sireuil; the idea of using the regenerative furnace for steel melting having been suggested by Lechatelier in 1863.

Another suggestion most fruitful in result was that of the use of a basis slag in the converter, made by the late Professor Gruner. Since that time 8,571,000 tons of basic steel had been produced in the different iron-making countries of the world, and in 1888, 600,000 tons of slag, averaging 36 per cent of phosphate of lime, had been returned to the agriculturist for use upon the land. The work of the late Professor Tresca on the flow of solids was of great importance, owing to the general introduction of hydraulic presses for forging purposes; and then in the late Congress of Mines and Metallurgy, held at the beginning of the present month, several valuable reports on presses, as compared with hammers, steel castings, and alloys of iron, were presented by Messrs. Brustlein, Everard, and Gauttier.

At the evening soiree, given by the members of the Societe des Ingenieurs Civils, apart from the musical and light entertainment, two very interesting novelties were exhibited, the first being a camera, having a horizontal motion about a central axis, driven by clockwork, which takes a complete picture, on a rolled sensitive film, of the whole horizon from a station at one revolution; and the second, a projecting lantern, which gave very distinct images on a screen of iron and steel fractures and other opaque objects. This consisted of two incandescent lamps of 15-candle power, the light of which is directed obliquely by parabolic mirrors upon the object placed on the meeting point of the two pencils, and in the focus of the object glass, which is an ordinary carbon combination, giving about 40-diameter amplification.

The Education of Engineers in Prussia.

Young men desiring to obtain positions as engineers or architects under the Prussian government must first graduate at a gymnasium, and then at the age of eighteen to twenty years begin their technical study. Those desiring to be civil engineers or architects commence with a two years' course at one of the technical high schools of Berlin, Hanover, or Aachen, and then undergo a preliminary examination in science, mathematics, and building construction. Then follows a second two years' course, after which comes the first examination. The successful candidate becomes a Regierungs Baufuehrer (assistant engineer or architect on public works). He then spends a year on some government work without salary, followed by two years as assistant to a government engineer or architect. The second examination then takes place, and comprises a design worked out at home, and another produced under the eye of the examiner without the assistance of works of reference. The candidate is then appointed Regierungs Baumeister (government engineer). Intending mechanical engineers have a somewhat different course of study. They commence with a year's apprenticeship in an engineer's works, then follow in succession two years at the high school, the preliminary examination, two years of practice, one year for passing the second examination—eight years in all. At the end of this probation the candidate is engaged on temporary work at a salary of \$2.50 or \$3 a day. Five years later he may expect a permanent post.—*Boston Journal of Commerce.*

Pneumatic Tubes in Buenos Ayres.

Buenos Ayres in the Argentine Republic has become one of the most progressive cities of the new world. In addition to railways, telegraphs, telephones, electric lights, and other modern conveniences, a system of postal pneumatic tubes is now being prepared for the more rapid distribution and collection of mail matter throughout the city. A recent number of *El Ingeniero Civil*, an admirable engineering publication, contains drawings of the proposed location of the pneumatic tubes, as prepared, under the direction of the Director-General of Posts and Telegraphs Dr. Ramon J. Carcano, by Otto Krause, C.E.

Correspondence.

A SUGGESTION IN INDICATION OF TIME.

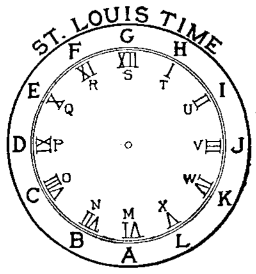
To the Editor of the Scientific American:

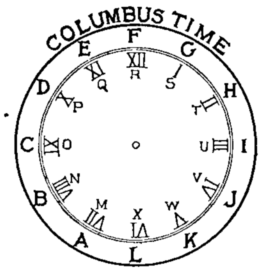
In the SCIENTIFIC AMERICAN of September 7, was an article suggesting the advantages of making divisions on the face of the clock so as to show twenty-four hours instead of twelve, as is now done.

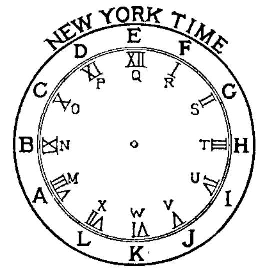
You referred to the danger of confusing the minutes and hours. That would certainly be a serious objection, and serious as it is, it is a great improvement on the present method.

I would suggest that we designate the hours as A, B, C, etc., to twenty-fourth hour, X, for railroad and similar uses, and also retain the present designations for everyday purposes. Let minutes remain as they are. The A B C time should be the same all over the continent. That is: Begin the railroader's day with A, at 6 o'clock A. M., St. Louis time. Suppose there is a difference in true time of two hours between St. Louis and New York, then the railroad day at New York would begin at 8 o'clock A. M., and at Columbus, Ohio, at 7 A. M., true time, but A time would be the same instant at the three places. Thus A o'clock would occur at the same moment the continent over, but 6 o'clock A. M. would be hours apart.

To avoid any confusion would be very simple, very. Thus: Mark in their proper places on the face of the clock A to L outside of the present hour marks, and in black letters. Mark M to X on the inside of the circle, and in red letters. No other change would be necessary in clocks, and watches could have adjustable bands with the A B C time noted, or, for railroaders, one movable band with the present marks would suffice. To make this clear, I make the following sketches:







There would be many advantages in such divisions of time, while now there is a regular babel of times, causing every railroad station to be filled with maledictions from belated passengers. What is more exasperating than the jumbling of times at Pittsburg, Pa.?

Not to mention the aggravation avoided in connection with railroad, there would be this great advantage: The exact moment when anything occurs in one part of the country could be understood all over the continent. For instance: Voting closes in New York at 6 P. M., that would be say 4 P. M. at St. Louis and 2 P. M. at San Francisco, or W o'clock at all these cities.

Time divided according to the foregoing plan would involve no great change or expense, and would be instantly understood by the simplest mind.

O. C. MEHURIN.

Passenger and Record Time across the Ocean.

A steamer's run across the ocean, when considered in point of time consumed, is one thing judged from the "racing" record and quite another from the passenger's. When a steamer leaves New York bound to Liverpool, the voyage, in the passenger's estimation, begins when she leaves her dock, but really she does not begin to be timed until three and a half or four hours later, when Sandy Hook Lightship is hull down and the land but a misty thickening on the western horizon. When the ship, having plowed her way over the Atlantic, makes Brow Head, which is some five miles north of Fastnet Light, where there is a signal station, the record of the log book is summed up, the figures are given; number of miles run, time consumed in the trip, and the official voyage ends. The passenger, however, soon discovers that, though he has "crossed," he is not yet by any means arrived, for Fastnet is in the broad seas, two miles distant from Cape Clear, itself an island off the extreme southern point of Ireland. There is sixty miles of ocean yet to cross to reach Queenstown, and even then Liverpool bar will be two hundred and thirty miles away, and twelve miles more in the Mersey, up from Rock Light, at its mouth.

In the same way ships out from Liverpool bound hence take their departure with Brow Head sunk deep under the quarter rail, and then only does the official voyage begin, though the passengers have, perhaps, been at sea for a day and a half, or even two days and a half, because of the detentions in the Mersey and at Queenstown and the three hundred miles run.

The Inman steamers have the same starting point here, summing up their runs when they sight Roche's Point, at the entrance to Queenstown Harbor.

The run of the North German Lloyd line counts from the time of losing Sandy Hook light to the Needles, some high rocks off the port of Southampton Harbor. Thence there is the long run to Bremen.

It may be said in explanation of this system of timing that it is only when running from land to land that a steamer's engines are run at full speed. In New York Bay, Queenstown and Southampton Water, and in the Mersey, she must slow down.

The Okonite Co. Receives a Gold Medal at the Paris Exposition.

Although the American representation at the Paris exposition is far from being commensurate with the prominence of our industrial position, those who did represent have received numerous awards. In the electrical department, however, American progress is, thanks to the enterprise of Mr. Edison, creditably represented, this display standing out as one of the conspicuous features of the exposition, and in one of the prime essentials of this department it is to be noticed that the Okonite Company, of New York, has been prominently distinguished, receiving an award of a gold medal. This company makes a superior compound for covering wires to give a high degree of insulation, with great durability, toughness, and resistance to the decomposing influence of the elements. A full description of the manufacture of telegraph, telephone, and electric light wires and cables by this company was given in the SCIENTIFIC AMERICAN of February 25, 1888.

Relief for Seasickness.

Dr. Ivan A. Mitropolsky, of Moscow, warmly recommends, on the ground of his personal experience, the following simple method for preventing or aborting all symptoms of seasickness. As soon as giddiness, nausea, etc., appear, the author shuts his eyes and begins to make deep and slow inspirations and expirations. In a few moments (sometimes after three or four respiratory cycles) the symptoms disappear, to yield to a comfortable subjective sensation. On their reappearance the same procedure is repeated again and again. If the recurrence be rather frequent, it is better to perform the procedure in a recumbent posture (with closed eyes). Since the time the author has begun to practice the method, he never yet suffered from vomiting when on board.

In referring to this case in the London *Medical Recorder*, Dr. Idelson says that Dr. Mitropolsky seems to think that the means proposed by him are novel. Meanwhile, in the *British Medical Journal*, March 24, 1888, p. 676, he will find a very interesting note by Dr. J. J. Leiser, in which the writer says (1) that seasickness is caused by irregular and imperfect respiration, leading, necessarily, to an inadequate aeration of the patient's blood, which consequently becomes poisonous to his brain and gives rise to sympathetic sickness; (2) that a system of regular, free breathing prevents sickness or rapidly relieves it; and (3) that his experiments were successfully repeated by Drs. G. C. Stockman and C. W. C. Prentice, who, having selected ten suffering passengers, each seated himself with five of them and "timed the breathing in the following manner: They (the doctors) raised the hand from the knee, indicating an inspiration, and down again for an expiration, thus timing the respirations to exactly twenty per minute. At the expiration of one hour the active symptoms in each case had entirely subsided." By this time the doctors had thoroughly educated their patients in the *modus operandi* of the cure. The cases continued to be permanent "cures" during the remainder of the voyage from Queenstown to the United States. The writers conclude by asserting that "the cure is infallible in all cases that persist in carrying it out."—*Medical Record.*

Play Grounds on the Tops of Houses.

A plan for school play grounds, which has obtained in London for some years, has been mooted in New York in connection with new school buildings in the crowded tenement district of the east side. In these regions space is limited and dear, and the play rooms are usually in dark and damp basements. Now it is proposed to try the experiment of having play grounds on the roof. The plan is to carry the walls up another story, but to have no roof. In wet weather a canvas top would be spread over the room, but at all other times the children would have the full benefit of the air and the sun. This experiment has been tried in London, and has been found to work satisfactorily, and in one case a glass roof—forming a "crystal room"—was set up, to the great delight and comfort of the little ones. The *Sanitary News* assures us that the aerial experiment in play grounds will certainly be tried in connection with one of the New York schools.

THE Michigan University, Ann Arbor, Mich., opened October 2, with over 2,000 students—a larger attendance than ever before.

Warnerke's Process.

Mr. Leon Warnerke early in the year 1881 made the important discovery that in a gelatine negative developed with pyrogallic acid the parts which have been acted upon by light are rendered insoluble in warm water, while those portions which have not been acted upon retain their original solubility. In fact, the gelatino-bromide film after exposure and development becomes precisely analogous to bichromatized gelatine—an exposed carbon print for example. The soluble gelatine can be dissolved away, leaving only those portions upon which the light has had no influence. One of the greatest advantages anticipated from this process was that glass in the field would be dispensed with and paper substituted in its stead, while, at the same time, other advantages would accrue. For example, halation would be avoided, and the operator would have more latitude in the exposure, as there would be practically two developments, both of which gave a means of modifying the ultimate result. Also, the negatives when finished could readily be either intensified or reduced to almost any extent.

The process is this: The gelatino-bromide emulsion is spread upon paper instead of upon glass. The emulsion must contain no alum or analogous material—this is an essential. After exposure in the camera the image is developed with pyrogallic acid in the ordinary manner. It may afterward be fixed or not, for it makes very little difference in the end. The negative thus far completed is squeegeed, face downward, on to a glass plate, either collodionized or not, and then placed in warm water. In a short time the paper comes off, leaving the film adherent to the glass. By the continued action of the warm water the gelatine, which has not been affected by the joint action of light and developer, dissolves away. In the end the image consists of the reduced silver in different thicknesses of gelatine, while the deepest shadows are simply bare glass. The negative can now be intensified to any required extent and by any method, one of the simplest being a solution of permanganate of potash. It will be seen that, as the shadows are free from gelatine, there is nothing to be stained. If the image, instead of requiring intensification, is too dense, it may be reduced by using hotter water, precisely as in developing an over-exposed carbon print.—*Br. Jour.*

What Modern Light and Heat Says.

Scarcely a day passes but some new development in science is heralded, some new invention to cheapen production, or some new application of existing forces is made. In the progress of gas, electricity, and steam the path is marked by new devices and appliances. No sooner is a new process devised than another one equal to it or even better comes out, until it seems as though the range of improvement in certain directions had been fully covered. In the field of gas production the changes in the last few years have been radical. Natural and fuel gas have come into use, new processes invented, until to-day gas is produced at a lower figure than ever before, and the gas engine, though not a recent production, has been remodeled and improved until it stands high in the class of transformers of energy. The steam engine, the dynamo, and the motor have all been subject to the same changes, until each year sees them more efficient and better suited to the demands made upon them. The electric railway, which has now come into general adoption, has in so short a time been developed into what is now a practical and commercial success that it scarcely seems possible, and yet it is claimed that a new application of this will soon be made on which such high speeds will be attained that our present electric street railways will be to it in comparison as one to twenty. It cannot be questioned that no science has in the past made such phenomenal development as applied electricity, and it is predicted that the next decade will see even a greater one.

Simple Dead Finish.

For a simple but not very solid dead finish for walnut, proceed as follows: Take equal parts of burnt umber and finely ground pumice stone, and mix them together. Apply with a woolen rag or hair cloth dipped in raw or boiled linseed oil. Clean with soft old cotton rags. The longer and harder the rubbing, the better the results. The walnut need not be filled or oiled.

LUMINOUS FOUNTAINS FOR DINING TABLES.*

The luminous fountains at the Paris exposition elicited universal admiration, and will certainly have an influence upon landscape artists who have in charge the decoration of public and private parks. They will certainly make use of this new method of producing startling effects. Already the managers of the Grand Hotel, of Paris, have transformed the fountain which decorates the middle of the court yard, and the spouts and sprays of different colors may be seen nightly. Mr. Gaston Menier, a well known scientific amateur, has devised a charming modification of these fountains, and has constructed a device that makes use of this application of hydraulics and electricity for his dinner

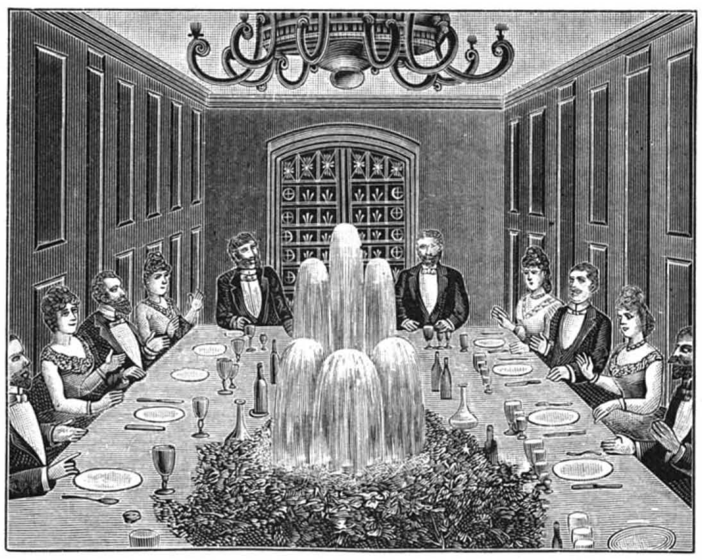


Fig. 2.—LUMINOUS FOUNTAIN AS USED AT THE DINING TABLE OF MR. GASTON MENIER.

table. We have already illustrated in these pages a curious feature of his dinner table in which the plates, etc., travel about the table on an electric railroad and stop in front of each guest. This new device, however, presented a more serious problem, as there was so little space in which to carry out the necessary steps, but all the difficulties were overcome by Mr. Menier, who personally directed the work.

An opening about 4 ft. long by 3 ft. wide was made in the center of the table, and this was lined with a zinc basin, *z z*, polygonal in shape and with sloping sides. The electric light projector is located at the middle of the bottom of the basin in a circular metal box, which has a mirror at the bottom, and a plain glass top. Six incandescent lamps are placed in a circle, three of which may be seen in the cut. Special pains have been taken to prevent the cold water from cracking the glass, which is somewhat near the six lamps. This is accomplished by placing a second plate of glass between the water and the other glass, which prevents contact of the water with the latter. Above this box are located two circular sprays, and one rose spray: water is supplied through pipes concealed under the floor. Each pipe is provided with a faucet located within reach of the host, who thus can regulate the different effects he wishes to produce. The variation in the colors is produced by means of the interposition of different colored glasses between the light reflector and the fountain. Each glass is mounted in a frame about a foot wide. These frames (see *c c*) slide in grooves arranged for that purpose. They are arranged in pairs with a sufficient space between them to allow the white light to pass when the water is not to be colored. Each pair of frames is provided with a chain which passes over a pulley, P, outside of the basin and to the chair of the host. The arrangement is clearly shown in Fig. 1. It is seen that, by moving the handles attached to the chains within the tubes, T T, the different frames are moved. There are five pairs of frames, and by combining these, various effects may be produced. For variegated lighting, plates of glass are provided with holes in the center, in which is placed a disk of another color. The central jet and the circular ones are thus colored differently. The whole device is covered and decorated with flowers, so that no one may suspect the arrangement underneath. An ordinary dining table is used, with a handsome basket of flowers at the center, and it may be well imagined what an effect is produced, when suddenly the different colored lights are turned on, and a fountain variegated in color is seen to spring from the center of the centerpiece of flowers.

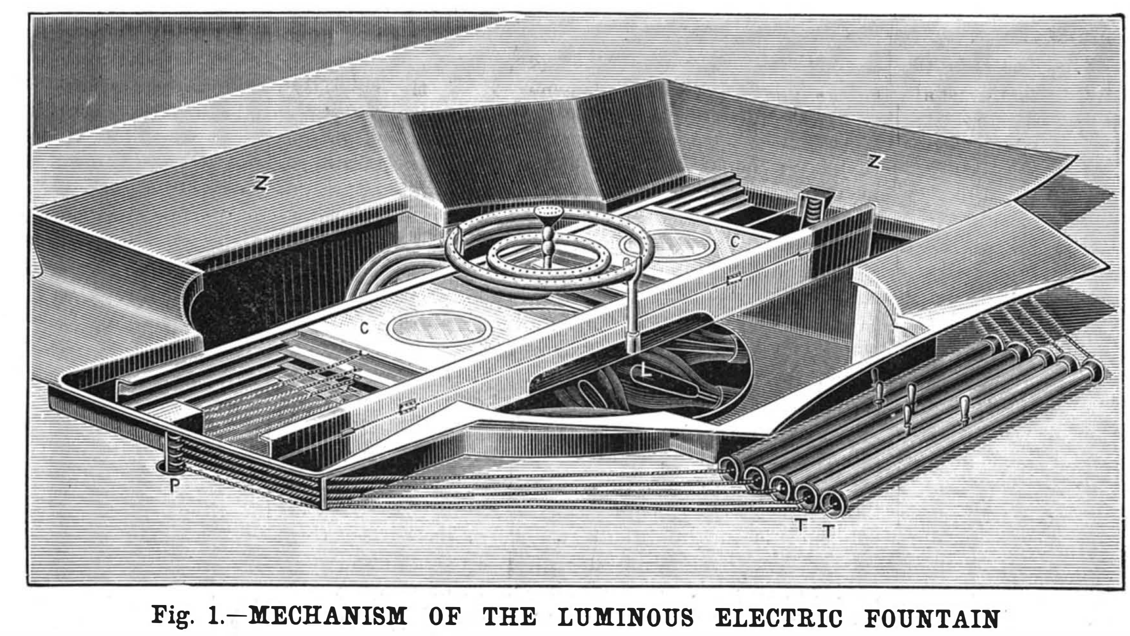


Fig. 1.—MECHANISM OF THE LUMINOUS ELECTRIC FOUNTAIN

* G. Mareschal in *La Nature.*

The Phenomenon of Light.

Prof. Wiedemann gives the name "luminescence" to the phenomenon of a body radiating light waves at a temperature which corresponds only to greater wave lengths, and he shows that the phenomenon is more frequent than is usually supposed. Luminescence includes all such cases as phosphorescence, fluorescence, vacuum tube discharges, as well as cases of chemical action, including many instances of flame.

Prof. Wiedemann's theory may perhaps be crudely indicated in a few words. In the case of a gas at a given temperature and pressure, its total energy, according to the usual hypothesis, is distributed according to a fixed and perfectly definite ratio between the internal vibrations of its molecules and their motions of translation. If this were not so, there could be no condition of equilibrium. If, however, the molecules be subject to certain kinds of periodic disturbance, the equilibrium between the two kinds of molecular motion may be upset. The balance tends to restore itself as soon as the exciting cause is withdrawn; but meanwhile, if the internal movements have been augmented at the expense of the external, we should have the phenomenon of luminescence. Similar views, with due restrictions, are applied to solids, and it is shown that if the restoration of balance does not appreciably commence until the excitation is withdrawn, we get what we call phosphorescence; if it proceeds concurrently, we have fluorescence. It would certainly appear that in the hands of Prof. Wiedemann this theory is at the very least destined to throw further light upon the nature of Geissler-tube phenomena.—*Electrician.*

The Shoe Contract System.

One of the curses of the shoemakers of Quebec is the contract system. In many shops the larger part of the work is let out at contract at a rate per pair, and the petty boss hires his own gang or team. For instance, one man will contract to do the lasting and tacking on of one sole, another will contract to do the heeling, another the finishing, etc. This has to some extent been done in our factories, but never to the extent that it is in Quebec. And while we have the division and subdivision of work down pretty fine, in some respects the Quebec manufacturers are ahead of us.

In one factory I saw six men lasting one shoe. They sat on benches similar to our hand sewers. The first man picks up the last and tacks on the innersole, draws the upper over the last, and drives a tack at the heel, toe, and shank. He then throws the last to the next man, who draws the upper into shape and tacks it just enough to hold. The third man begins lasting the toe, and the next the heel, and so on until the shoe is ready for the heeler.

It is surprising how expert men become in performing their several parts. I timed a gang who were making hand-nailed work, and from the time when the first man picked up the upper and last to the time when the shoe was ready for the heeler—lasted and sole laid and nailed—was just three minutes. It seems also incredible that this should be the case, yet it is true nevertheless. I have seen some pretty quick lasters working in some of our Brockton and Lynn factories, but for genuine hand-lasting machines I have to give Quebec the palm.—*Boots and Shoes.*

CARRIAGE manufacturers are predicting that in the not distant future wooden wheels will be done away with, and steel wheels substituted, on account of the increasing scarcity of lumber for wheels.

THE PITS AND DOMES OF MAMMOTH CAVE.

BY H. C. HOVEY.

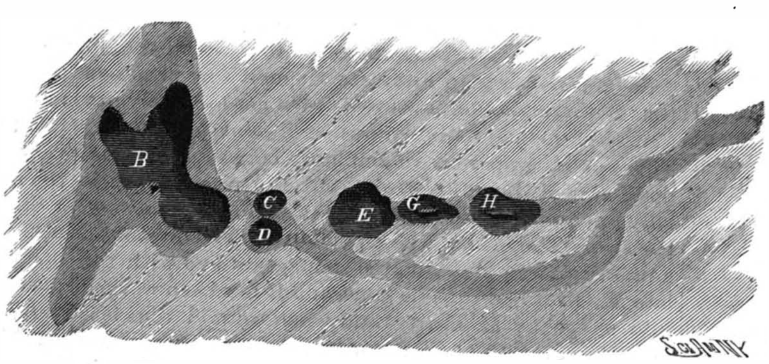
Oval valleys in cavernous regions convey the surface waters to subterranean channels, whence they finally emerge as flowing streams. These channels are usually horizontal avenues whose walls retain horizontal projections that mark successive drainage levels. There are five such levels, or tiers, in Mammoth Cave. Here and there these floors are broken through, thus forming spacious halls with surrounding galleries. The noblest specimen of these is a locality known as "The Chief City," an assembly hall for dusky warriors and sagamores in prehistoric times, as is proved by the tons of Indian relics that have been found there, most of which have been carried away by visitors or else consumed as bonfires to light up the cave. Bayard Taylor measured the room and published his figures: "Length, 800 ft.; breadth, 300 ft.; height, 125 ft.; area, between four and five acres." The dimensions have been carefully taken this year, and after allowing for every possible error, we now report the Chief City as being but 450 ft. long, 130 wide, with a circumference of about 1,500 ft., and an area of about one and one-third acres. Yet these are surprising dimensions, and leave it as the largest of known cave halls with a single exception.

Numerous vertical shafts have also been cut, by the action of whirling water freighted with sand and gravel. Some of these are diminutive affairs, while others are truly frightful abysses. One who should approach a shaft from an upper level would call it a "pit," while he might describe the same cavity as a "dome," should he approach it from a lower level. Of course this has created some confusion in cavern nomenclature. At the extremity of Bat Avenue you find a long narrow opening called the Crevice Pit. And for thirty years that was its only name. But then it was discovered that the enlargement below was into an enormous room called the Mammoth Dome. It is not easy to realize that the narrow pit and the mighty dome are identical.

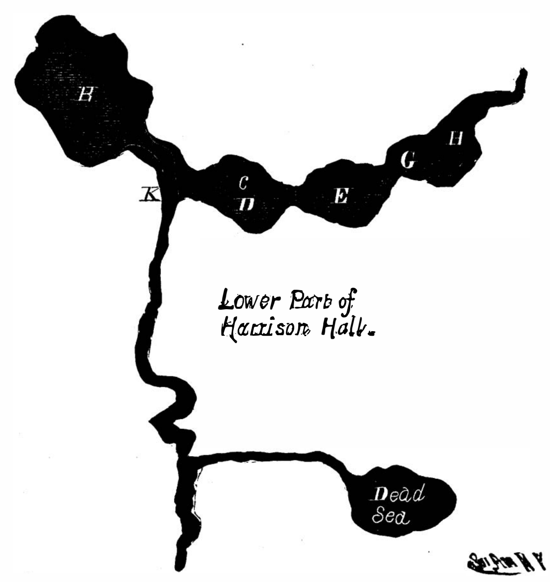
My exploration of this interesting locality led to the conjecture, some years ago, that other pits might be found to undergo similar enlargement below the upper level by which they were approached; and that all the domes, if examined from above, would be found to terminate in pits instead of being capped by slabs, or ceilings, or roofs, as they are commonly said to be. My inquiries were directed to various portions of the great cavern, but the most important results were obtained in the remarkable region of pits and domes reached by leaving the Main Cave through the aperture behind the monolith known as the Giant's Coffin. Some of these have been visited by thousands of tourists, whose narrations have made Gorin's Dome, the Side-Saddle Pit, and the Bottomless Pit familiar to many readers. The early reports were absolutely extravagant. And even sober geologists, who have doubtless meant to tell the truth, have accepted and published such reports without verification. As the vertical distance, from the upper surface of the limestone, whence the cave is carved, down to the lowest drainage level, has been determined by barometric measurement to be but 328 feet, it is possible that some of the shafts cut through the entire series of tiers might show a corresponding depth, were they free from *debris.* But as all of them are thus encumbered, that fact must always be taken into consideration in every estimate.

Creeping through a low passage opening from the Arched Way, the Covered Pit is presently reached. It has long been known, but never crossed by a visitor until about eight years ago, when, following the intrepid guide William Garvin, I ventured over its loose slabs of limestone, reasoning that stones which had held their position for unknown centuries would not be likely to give way merely because a few more pounds were added to their weight. Safely beyond this dangerous chasm, we explored the hitherto unknown realm with highly interesting results. Only a few steps had been taken before we encountered another shaft, which we provisionally call Pit No. 2. Its mouth takes up the entire passageway. The roof is partly arched. The chasm itself is an irregular oval, estimated at 10 by 20 feet across. Skirting around it by a side passage, we found Pit No. 3. The floor and roof of the way were so close together as to leave barely room for us to lie on our faces and pull ourselves out on a rock overhanging the abyss. This pit was circular and overarched by a dome whose height was estimated at 30 feet.

Let me here remark that the region I am now describing has not been visited since then by any one except the guides, until last April, when Mr. Ben Hains, of New Albany, whom I had requested to obtain photographs of various places in the cave for my use, laid his camera aside, and with plenty of material for chemical fires, and with a very long line and a suitable plummet, followed in my footsteps in order to complete the perilous task I had previously begun. He lingered long enough over the Covered Pit to drop his lead through its black crevices and determine its depth to be 47 feet, although the appearance when lighted by fire balls indicated a much greater depth. He found the first bottom of Pit No. 2 to be 37 feet below the ledge of observation. But on illuminating it a black spot was seen near the center of the floor, into

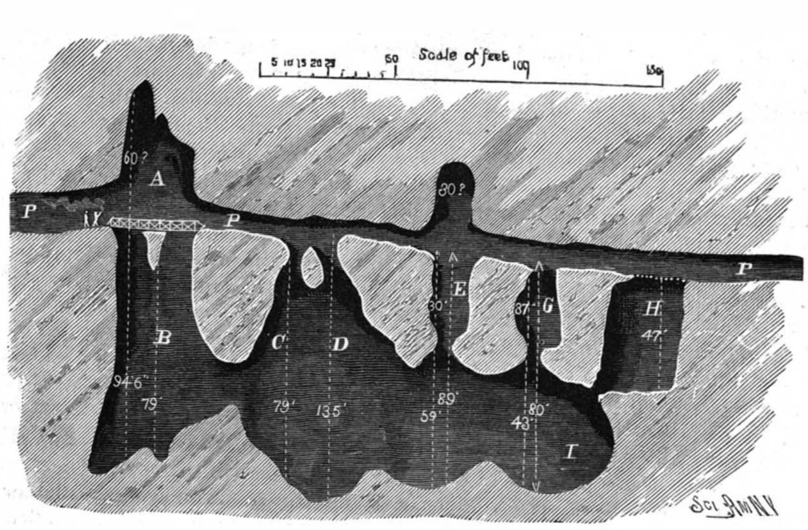


which, after several attempts, Mr. Hains succeeded in dropping his plummet, when the line spun out for 43 additional feet before resting, thus making 80 feet in all. Pit No. 3 was found to be only 30 feet deep. But a suspicious black spot attracted attention near the farther side, only about a foot in diameter, that might have passed for a shadow had not the explorers already had some experience concerning such indications. The guide wrapped a cloth saturated with coal oil around a pebble and succeeded in hitting the mark. The burning ball went roaring down into what proved to be a



very deep pit. It is difficult for any one who has not been similarly situated to realize what a dismal, melancholy sound is made by such a weird messenger. It required some dexterity for Mr. Hains to swing the lead and drop it into the hole; but when done the line ran out 59 feet more, making 89 feet in all.

Scylla and Charybdis, twin pits that lie beyond, were described and named by me in 1881. Their black jaws yawn on either side of a sort of rude bridge of rocks wedged in between. In other words, the two pits are really but one, the upper portion being divided by a narrow wall. Clambering down into Scylla to a con-



venient ledge, I timed the fall of pebbles and concluded the depth to be 220 feet. The guide lowered a lighted lamp till it rested at a point far short of that distance. In trying to disentangle the cord it was burned off, and what remained was 135 feet long. The ledge on which the guide and I sat was a mere strip with a wide crack running through it. On leaving it a large fragment of rock was dislodged that went thundering down the chasm. On gaining the narrow path, only a foot wide, we climbed up to the more level way on the opposite side. A few more steps brought us to the farther edge of the Bottomless Pit, with its bridge in full sight, fifty feet away, and Shelby's Dome above it. There is no dome above Scylla and Charybdis, the roof being quite flat, and not more than three feet from the floor of the passageway. William thought it possible to crawl down into the Bottomless Pit for a short way and thus cross to the bridge. But it seemed safer to return as we had come in. Accordingly we retraced our steps until we regained the familiar path trodden by so many thousands. I regret that Mr. Hains did not measure Scylla, especially as he doubts my own figures above; but he measured Charybdis, and found it to be 79 feet deep.

The task remained of getting to the very bottom of these pits whose mouths we had been examining. Our supposition was that the singular winding way known as Fat Man's Misery had at some former time been the channel through which the waters accumulating in the pits when less deep than now found their exit to the large bodies of water in River Hall. Entering therefore a rift in the rocks pointing back toward the pits, we had no great trouble in reaching what proved to be the Bottomless Pit, at a point about 40 feet from its bottom. By burning magnesium we could plainly see the bridge far above our heads. A volume of smoke attracted our attention, issuing from a window not far from us, which was found to be an opening into Charybdis. The smoke came from blue fire we had ignited just before leaving it. The idea was then suggested to my mind that all these numerous pits, clustered within an area not exceeding 600 yards in diameter, were probably connected with each other. This has now been confirmed by Mr. Hains' more recent discoveries. Aware of what had already been done, he made another and a successful attempt to reach the lowest level. He found, in the lower corner of the room known as Great Relief, an opening into a narrow, tortuous, and muddy passage, which he followed for half a mile, meanwhile crossing a branch that leads out to what is called the Dead Sea. Suddenly he emerged into a vast and gloomy place which proved to be Charybdis. He was on the very floor of the profound chasm. By the aid of powerful magnesium lights the outlines of the immense hall were made visible. It has the appearance of some vast cathedral, and its magnitude is surprising when compared with the size of the pits that open from it like so many chimneys. The largest part is directly under the Bottomless Pit. Beyond it the width of the hall varies from 10 to 30 feet, and its height varies from 35 to 135 feet according to the uneven floor which rises in a series of high pointed hills, steep and slippery. It changes to a crevice only six feet wide. The last 20 feet of the floor was composed of loose rounded sandstone rocks, sloping up against the end, where there was a cascade, which probably falls down through the Covered Pit, as the noise it makes can be heard from above. In the walls were found fossil shells and corals, the latter in large bunches like petrified moss. These are characteristic of the Saint Louis limestone, and the sandstone belongs to the overlying Chester group.

Mr. Hains regards the deepest part of this hall to be the lowest corner of the Bottomless Pit, where he found a measurement of 94 feet and 6 inches. Add to this the height of the upper passageway and the overarching Shelby's Dome, and the total would probably be as much as 160 feet. Directly under the bridge the distance is 79 feet. From under side of the bridge hang long graceful fringes of fungoidal growth, white as snow, and looking like splendid stalactites. The view was superbly grand on every side, and equal to anything else yet found in Mammoth Cave. The place is not of easy access, and will probably never be thrown open to the public. Indeed, it was with difficulty that Mr. Hains and his guide, William Garvin, succeeded in getting out from the lowest part of Charybdis, which they effected only by the aid of a timber that had floated over from the ruin of one of the old bridges during some rise of the waters. It is not yet proved that Gorin's Dome, the Side-Saddle Pit, and Ariadne's Grotto are connected with the rest of the group, although that is my confident conjecture. But we certainly have demonstrated that six or more great pits are united into one subterranean apartment of magnificent proportions. It is respectfully suggested that this newly discovered and wonderful room should be named, in honor of the President of the United States, "Harrison Hall."

The accompanying cuts were sketched under peculiar difficulties, and are merely designed to help the reader to get a general idea of this interesting locality.

A SPRING of natural cologne, with the perfume of patchouli, has been discovered in Algiers.

Viper Bite Treated by Alcohol.

BY JOHN B. HAWES, M.D., ASSISTANT SURGEON, STEPHANS HOSPITAL, REICHENBERG, BOHEMIA.

In making my rounds of the wards on Sunday, the 7th of July, my attention was attracted by a priest administering the last sacrament to a youth. The religious ceremony being ended, I proceeded to examine the patient, a boy aged twelve, and found that twenty-four hours before, while gathering whortleberries, barefooted, he had been bitten by a viper in the toe. The marks of the fangs were plainly to be seen.

The boy was unconscious, pulseless, and cold. The leg swollen to the hip and quite blue. A faint and very rapid heart beat and a hurried and superficial respiration showed plainly the desperate condition of the patient. Hot claret and warm covering had been used against the collapsed condition, but the patient vomited the claret immediately. The doctors, who had been in consultation, had informed the family that the boy must die,and at the time of my visit the father and brother were waiting in the corridor, expecting every moment to be informed that the end had come.

I ordered a bottle of fine cognac at once, and at four o'clock P.M. commenced giving teaspoonful doses of pure brandy by pouring it well back on the tongue every five minutes. Not until about six o'clock was any improvement to be noticed, although the brandy was retained. At this time, however, the pulse was to be felt, though it was very faint.

This treatment was kept up, increasing the intervals somewhat between the doses, until midnight, when the patient was conscious and the heart's action improving. After ordering tablespoonful doses of cognac to be given every half hour during the night, I returned home.

The next morning the visiting doctors were astonished to find the boy not only alive but very drunk, the heart working beautifully. He had taken in this time about fifteen ounces of brandy. The leg had in the meantime been rubbed every half hour with camphor water, and its warmth and rosy spots here and there showed the renewed circulation. The brandy was discontinued and the external treatment kept up. Rubbing, however, caused much pain, as the limb was extremely tender. Owing to this fact, indeed, the patient could not be discharged until the 19th, twelve days after his admission, though he had entirely recovered from the effects of the bite, as well as of the brandy, by the fourth day.

The case has excited much interest here, and was published in the Vienna and Prague as well as the local journals as a novelty, for, strange to say, the doctors here were not familiar with the cowboy method of treating snake bites.

The interesting point in the case is that the alcohol produced its effect at so late a stage, and that it caused no vomiting.—*The Medical Record.*

Opening of the New Dry Dock at Norfolk.

This new government structure was successfully opened on the 19th ult. The work of flooding the dock commenced at ten o'clock, and a few minutes before twelve o'clock the Yantic was swung around and into the dock, and two hours later rested high and dry on the bilge blocks ready for such repairs to her bottom as might be necessary. An elaborate banquet followed in the loft of one of the large buildings in the yard, at which all of the officers of the yard, in addition to the visiting party, were present.

The construction of the dock was commenced in December, 1887. The time limit expressed in the contract is 24 calendar months, but the time consumed was only 21 months, and had it not been for the unfortunate flood of April last, which filled the basin and entailed a great deal of damage, the structure would have been ready to receive a vessel July 1 last. The dimensions of this magnificent dock are as follows:

Length over all on coping, 530 ft.; length over all inside of caisson, 500 ft.; width on top amidship, 130 ft.; width on floor, 50 ft.; width on floor at entrance, 53 ft.; width on top at entrance, 85 ft.; depth of gate sill below coping, 30½ ft.; high water, 25½ ft.

The machinery for operating the dock consists of two centrifugal pumps, each 42 inches diameter, driven by two vertical engines 28 inches diameter of cylinder by 24 inches stroke, with adjustable cut-offs, steam power being furnished by three steel Scotch boilers, 13 ft. diameter and 11 ft. long. The entire pumping plant was furnished by the Southwark Foundry and Machine Company, of Philadelphia.

These pumps have a capacity of 80,000 gallons per minute, enabling the dock to be emptied of water (without a vessel) in about ninety minutes, and with a vessel of moderate displacement in much less time. The contract price for this dock complete is $500,000.

The docks constructed by Messrs. J. E. Simpson & Co. have been highly approved by the highest authorities in this as well as in foreign countries, and they may well feel gratified with this their latest production. They have also the contract for the dock at the Brooklyn Navy Yard, which is nearing completion, and at the United States Navy Yard, League Island, Pa.

The Hydraulic Railway at the Paris Exhibition.

In the SCIENTIFIC AMERICAN SUPPLEMENT, No. 717, we gave illustrations and a description of this curious exhibit. The following additional account, which we find in the *Engineer*, will be found interesting:

There has been in operation at the Paris exhibition since the 20th of July a very remarkable invention, Barré's Chemin de Fer Glissant. Certain very erroneous notions have been formed concerning it which the following description will perhaps set at rest.

Many years ago an engineer, whose name we forget, proposed to substitute for wheels slippers which should slide on rails; and to lubricate them it was proposed that the rails should be wetted. We need scarcely say that the scheme was ridiculous, and came to nothing. There is an apparent resemblance between this proposal and M. Barré's railway, but the resemblance is only apparent, there being a vital difference between the two. The idea of the Chemin de Fer Glissant in a practicable form originated some years ago with the late M. Girard, of turbine fame, and it has been worked into shape by M. Barré; and when we add that it is looked upon with much favor by most eminent French engineers, it will be seen that "there is something in it." The principles involved admit of being stated in a very few words. If two smooth plates of iron in contact have water under pressure forced between them, they will be driven apart, the water escaping all round; and if the distance is small, capillary attraction will reduce the discharge. Under these conditions, the friction of the plates on each other would be reduced to nothing in theory, and in practice it would be extremely small, and due only to the possible contact here and there of the two metal faces. M. Barré carries his vehicles on *patins*, or slides, and plate rails. Each *patin* is fitted with a pipe at the upper side, and through this water is driven at a pressure of about 150 lb. on the square inch. The result is that metallic contact is prevented, and the resistance of the slide to motion becomes almost incredibly small. So much for the first principle.

Secondly, in order to propel the train thus supported, M. Barré fixes under his carriages what is literally the driven buckets of a turbine unrolled; that is to say, a trough fitted with cross blades. Along the railway he lays a water main, provided at intervals with stand pipes. The ends of these pipes are fitted with a few guide vanes, and constitute a section of the guide wheel of a turbine unrolled. Water is discharged from these into what we may term the bucket rack under the carriages, and the rack is propelled, and with it the carriages, just as the driven ring or bucket wheel of a turbine is propelled. The whole scheme is thus perfectly simple, mechanical, and consistent with well-known hydraulic laws. The principles involved being stated, we may now proceed to consider how they have been carried out in practice.

The little railway in the exhibition grounds is 500 ft. long, and is carried on a light iron framing about 6 ft. high. No attempt has been made to keep it level, and one end is considerably higher than the other. Some of the inclines are as steep as 1 in 50, but they make no difference to the progress of the train. The rails are of cast iron, 9 in. wide, and planed. They are laid to about the normal gauge, and rest on longitudinal timbers. The space between the longitudinals is made up with sheet iron, on to which the water escaping from the slides is discharged, and collected for use over and over again. The hydraulic main is fitted with air vessels, which are simply enlargements of the pipe, and a pressure is maintained in the main by a pumping engine at one end. The pressure is about 150 lb. per square inch. The sleepers, or *patins*, are about 18 in. long, and a number of shallow grooves is made on their faces, for just the same reason that grooves are put in the piston of an indicator, namely, to diminish leakage. The stand pipes, or *propulseurs*, are disposed at such intervals that one is always acting on a train. As the train approaches each it opens a valve, and water is discharged into the bucket rack. As the train leaves it, it closes the valve and prevents the further discharge of water. Thus it will be seen that the distance apart of the *propulseurs* is fixed by the length of the train. Long trains, however, might have more than one *propulseur* in action at a time. There are, it is proper to explain, two bucket racks and two sets of stand pipes; one for driving the train in one direction, the other for propelling in the opposite direction. The water for the *patins* is carried in a steel plate reservoir, a heavy pressure of air being maintained in it to expel the water. The vehicle carrying the reservoir weighs six tonnes, the carriages two tonnes each, seating twenty-four passengers. The surface of each *patin* is about 150 square inches, and the load on it 1·5 tonnes, or 3,000 lb., and 3,000 ÷ 150 = 20 lb. per square inch, and if the water can be maintained at that pressure between the surfaces, no metallic contact can take place. About this there seems to be no difficulty.

In the little experimental line there is a fall at each end. The train stands at rest on this incline, the water being shut off. When the signal is given to start, the driver opens a valve, and water is driven between the slippers and the rails. The train then starts instantly down the hill, the *propulseurs* then come successively into action, and the train proceeds on its way. Even when running at its highest speed it can be stopped with startling rapidity by shutting off the water from the slides. The moment the two metal faces come into contact, a very powerful brake action takes place. The consumption of water for each slide is stated by M. Barré to be 60 liters per minute, or a little over 13 gallons. The water required for driving the train he gives as 8 gallons per ton per mile, under a pressure of 150 lb., the smallness of the quantity being due to the fact that the train has scarcely any resistance save that of air. The 500 ft. at Paris are traveled in half a minute, including the time spent in starting and stopping. This is a little over eleven miles an hour, and is very good work indeed, considering the shortness of the line.

Such, then, in brief, is the Chemin de Fer Glissant otherwise known as the hydraulic railway. It is obviously impossible, on the limited data available, to pronounce an opinion concerning its future of much value. Nothing can be said concerning the cost of working. It is clear that in its present form, at all events, it cannot in any way compete with steam on the great lines. But there are, no doubt, many places where water can be had for nothing under pressure, to which th system would be suitable. So far, however, as we can learn, the intention of M. Barré is to push his invention for elevated railways in cities. For such it has, no doubt, supreme advantages. It is practically entirely noiseless; there is no smoke, no dust; and the motion is luxuriously easy. There can be no derailments, and the weight of the rolling stock can be reduced to the lowest dimensions. Further experience is, however, needed. Sir Edward Watkin has been so impressed with what he has seen that on behalf of the Metropolitan Railway Company he has offered M. Barré a site near London on which to erect an experimental line two miles long. If the track is circular, we shall have the largest turbine ever made, its diameter being about two-thirds of a mile. We may add, in conclusion, that M. Barré believes that hitherto unheard-of railway speeds may be attained on his system. Time will show, perhaps, how far his expectations will be fulfilled.

Disease of the Heart.

In diseases of the heart which persist for a long time and finally end—as a very large proportion of them do —in slow decline and a lingering death, dropsy always sets in. In the late stages it is a most intractable symptom, and adds greatly to the suffering experienced. In the treatment, physicians have been wont to depend largely upon a diet of milk, which, in cases where it is well borne and can be persisted in, always acts well. But there are many patients who, for various reasons, cannot be kept on a milk diet for any length of time. To some it becomes abhorrent after a while, and others cannot really digest it properly, as simple food as it is. And, besides that, a milk diet is unsuited to no small proportion of patients affected with cardiac diseases. We have reference to those who cannot be kept quiet, says a writer in the Boston *Journal of Commerce*, but who insist upon being up and about, often in the open air, if not engaged in light duties. Prof. Germau See, of Paris, has long been engaged in study to learn what elements in milk rendered it such an admirable agent to stimulate the kidneys, increase the flow therefrom, and hence prove of such great service in dropsies. As a result of his investigation he is convinced that the one important element is sugar of milk. Acting upon that theory, he selected twenty-five patients with heart disease, in all of which there was more or less dropsy. To each he gave 100 grammes of the sugar of milk a day, dissolved in two quarts of water. In all these cases a marked effect upon the kidneys was felt within twenty-four to forty-five hours, and the dropsies diminished rapidly, and almost all such swellings disappeared altogether after a series of treatments lasting from six to eight days. This discovery is likely to prove one of the most important which has been made in the medical world for years.

Endorsing.

The system of endorsing is all wrong, and should be utterly abolished. It has been the financial ruin of more men than, perhaps, all other causes. *Bookkeeping*, a journal devoted to merchants, clerks, and business men, advises our young men especially to study the matter carefully in all its bearings, and adopt some settled policy to govern their conduct, so as to be ready to answer the man who asks them to sign his note. What responsibility does one assume when he endorses a note? Simply this: He is held for the payment of the amount in full, principal and interest, if the maker of the note, through misfortune, mismanagement, or rascality, fails to pay it. Notice, the endorser assumes all this responsibility, with no voice in the management of the business and no share in the profits of the transaction, if it proves profitable; but with a certainty of loss if, for any of the reasons stated, the principal fails to pay the note.

MEASUREMENT OF RESISTANCE.*

The simplest method of measuring resistance is that known as the substitution method, in which the unknown resistance and a galvanometer are placed in the circuit of the battery. The deflection of the galvanometer needle is noted A variable known resistance is then substituted for the unknown resistance, and adjusted until the deflection is the same as in the first case. The variable known resistance will then equal the unknown resistance. If the current is so great as

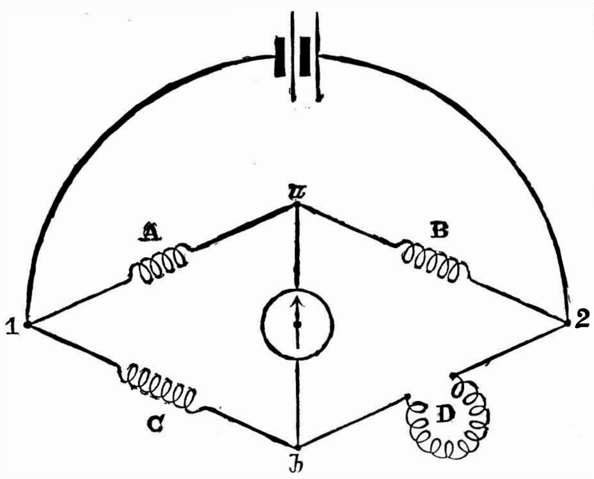


Fig. 1.—DIAGRAM OF WHEATSTONE'S BRIDGE.

to cause a deflection of the needle much exceeding 45°, it should be reduced either by removing some of the battery or by the introduction of extra resistance into the circuit. The same conditions must obtain throughout the measurement.

The Wheatstone bridge presents the best known method of quickly and accurately measuring resistances. Any galvanometer may be used in connection with the bridge, the Deprez-D'Arsonval galvanometer being the best for most purposes. The bridge method was originally devised by Mr. Christie. The late Sir Charles Wheatstone's name is attached to the invention, in consequence of his having brought it before the public. The principle of this apparatus is illustrated in Fig. 1. A current, in passing from 1 to 2, divides, a part passing over 1, *a*, 2, another part passing over 1, *b*, 2. For every point in 1, *a*, 2 there is a point in 1, *b*, 2 having the same potential. If these two points of equal potential be joined by a conductor, no current will pass through the conductor. In the diagram the

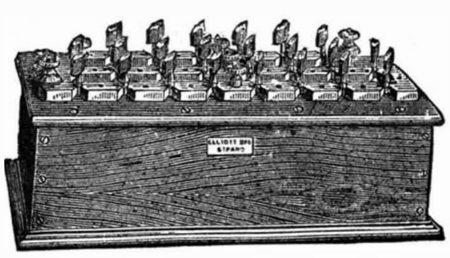


Fig. 2.—BRIDGE RESISTANCE BOX.

points of equal potential are marked *a*, *b*, and they are connected by a conductor in which is inserted a galvanometer.

A, B, and C are known resistances, and D is the unknown resistance. When A : B : : C : D, the galvanometer needle will stand at 0. The resistance, C, is variable, so that when the unknown resistance, D, is inserted, the resistance, A, is adjusted until the needle falls back to 0.

The commercial form of Wheatstone's bridge is represented in Fig. 2.

In this instrument a number of coils are suspended from the vulcanite cover of the box and connected with brass blocks attached to the cover in the manner shown in Fig. 3, which represents a part of the resistance box.

The terminals of the coils are connected with adjacent blocks, so that a current entering at A will pass from the first block down through the first coil, thence to the second block. In the present case the second

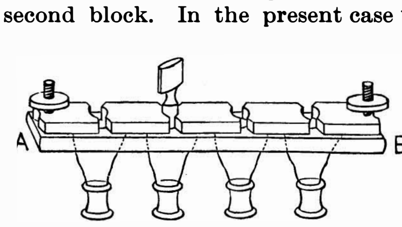


Fig. 3.—RESISTANCE BOX CONNECTIONS.

and third blocks are connected electrically by a plug inserted between them, so that the second coil is cut out, the current taking the path of least resistance. The current can pass from the third to the fourth blocks only by going through the third coil, and to pass from the fourth block to the fifth, the current must pass through the fourth coil. Whenever a plug is inserted it cuts out the coil connected with the blocks between which the plug is placed, and when a plug is removed, the coil at that point is thrown into the circuit. The coils of the resistance box are wound double, so that the current passes into the coil in one direction and out of it in the opposite direction, thus perfectly neutralizing any magnetic effects.

Fig. 4 represents the top of the bridge resistance box, and the circuits diagrammatically. The three branches including the known resistance of the bridge, are contained in the resistance box. In this diagram the connections of the battery and galvanometer, as shown in Fig. 1, are transposed for the sake of convenience in calculation, but the results are the same. The resistances, A B, of Fig. 1 are each replaced here by three coils of 10, 100, and 1,000 ohms. These are called the proportional coils. The rest of the resistance box constitutes the adjustable resistance ; and *x*, connected at D and C, is the unknown resistance.

The galvanometer is connected at D B, and the battery at A C. The value of the unknown resistance, *x*, is determined by simple proportion—

$$x : R : : s : S.$$

As shown in Fig. 4, the variable resistance R = 2163 ohms, s = 10 ohms, and S = 1,000 ohms, therefore x = 21·63 ohms.

The value of the proportional coils may be expressed as follows :

$$\frac{10}{1000} = \frac{1}{100}$$

$$\left.\begin{array}{l}\frac{10}{100}\\[4pt]\frac{100}{1000}\end{array}\right\} = \frac{1}{10}$$

$$\left.\begin{array}{l}\frac{10}{10}\\[4pt]\frac{100}{100}\\[4pt]\frac{1000}{1000}\end{array}\right\} = 1$$

$$\left.\begin{array}{l}\frac{100}{10}\\[4pt]\frac{1000}{100}\end{array}\right\} = 10$$

$$\frac{1000}{10} = 100$$

Also

$$\frac{1010}{100} \qquad \frac{1100}{10} \qquad \frac{10}{1100} \qquad \frac{100}{1010}$$

The arrangement of the proportional coils may be 1,000 : 1,000 for large resistances, and 10 : 10 for small resistances. In using the Wheatstone bridge in testing cables or in measuring the resistance of an electromagnet or a coil, to avoid delay caused by the deflection of the needle before the current becomes steady, it is best to send a current through the four arms of the bridge (s, S, R, x) before it is allowed to pass through the galvanometer. This is accomplished by means of the bridge key, shown in Fig. 5, together with its connections.

This is in reality nothing more than a double key arranged to control the two parts of the circuit independently, the upper key being arranged so that after it is closed it may be still further depressed to close the lower one, the two keys being separated by an insulating button.

The binding posts, *a b*, of the upper key are inserted in the wire which includes the battery, while the binding posts, *c d*, of the lower key are inserted in the conductor including the galvanometer. When this key is depressed, it first sends the current through the arms of the bridge, and then allows it to pass through the galvanometer.

* From "Experimental Science," by George M. Hopkins. Munn & Co. publishers, New York.

What Mr. Edison Noticed in Europe.

Mr. Edison has returned from Paris, and among the remarks he made to the reporters are the following :

"The Paris exposition is simply bewildering ! It is grand ! Immense ! If the Americans hope to surpass it they will have to get to work and never loiter. By the way, how is our Columbus centennial affair progressing ? Do you suppose they are really going to hold it here ? They don't seem to be raising money very fast. It's a pity that our laws prevent raising money by the lottery system as the French did. There is no doubt that the exposition will be a success if the managers only get about it fast enough. I will fill every inch of space they are willing to give me, and there are hundreds of those who have exhibits at the Paris exposition who will do the same. The only thing I objected to in the Paris exposition was that they had their machinery scattered too much. There were sixty-five miles of aisles in it, and a man does not like to travel so far to see machinery."

Every sort of electrical device was exhibited, he said, at the exposition, but there was really nothing that he could say was new to this country. He had twenty-five phonographs talking, playing, and singing constantly. They fairly set the French people wild with enthusiasm. Mounet Sully, the French tragedian, was greatly pleased with the phonographs, and whenever he came around always insisted on delivering soliloquies from "Hamlet" with different intonations, in order to hear them repeated.

A NEW INVENTION.

"I did not receive any valuable suggestions that I know of, in electricity, over there," said he. "I am studying on a device for a telephone, so that you can see the man you are talking to. I am almost sure I can make it a scientific success, but I doubt if it will ever be a commercial one. Anything that is not a commercial success, of course, I won't bother with. The scientific men abroad were greatly surprised that I was not more of a scientist, in the higher sense of the phrase. They could not understand that I am between the scientific man and the public.

"At Heidelberg the German association of advanced scientists gave me a dinner, at which were 1,200 guests. The Grand Duke of Baden was there, with all his guards, and he delivered an address through the phonograph in German. It brought down the house. Every word of it was delivered in such clear tones that it could be heard out of doors. The people go to bed in that town at ten o'clock, but that night we were making things hum at three."

Professor Hertz, of Baden Baden, Mr. Edison said, was the deepest electrical scientist he had encountered in his travels. He thought that from experiments the professor was making he was on a fair road to discover just what electricity is.

"Electric lighting in England and Berlin," Mr. Edison added, "had taken a great boom when I was there. All the foreign cities are ahead of New York. At Deptford, in Germany, I went to see the great 10,000 horse power dynamo in operation. The Grand Opera and all other theaters in Paris are lighted by electricity, and no gas is allowed in them."

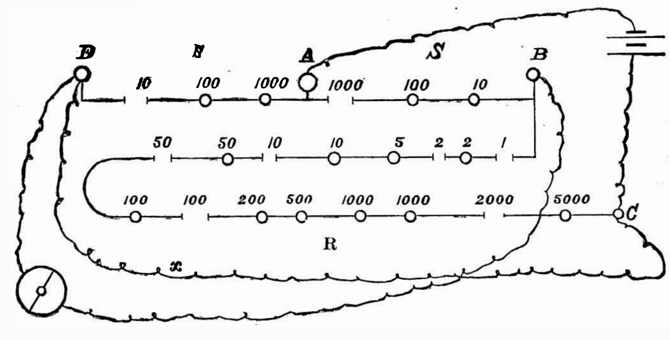


Fig. 4.—DIAGRAM OF BRIDGE CONNECTION.

The Hudson River Illuminated.

"The increase in the number of electric light plants in towns and cities along both shores of the Hudson river is rapidly making the river at night a brightly illuminated marine highway, and pilots of steamboats of the night lines are well pleased with the situation," says a writer in Poughkeepsie. "When the clouds run high on a cloudy night," said a pilot, "you can see the reflections from the towns and cities lighted by the electric lights fully sixteen miles. Yonkers is only seventeen miles from New York, and the sight is very clear between the two places. Pretty soon you come into the electric light of Tarrytown and Nyack, and it lasts you till you get to Stony Point. From the latter place up through the Highlands it is very dark, but you strike another electric light wave as you round West Point. It is from Newburg, and the whole of Newburg

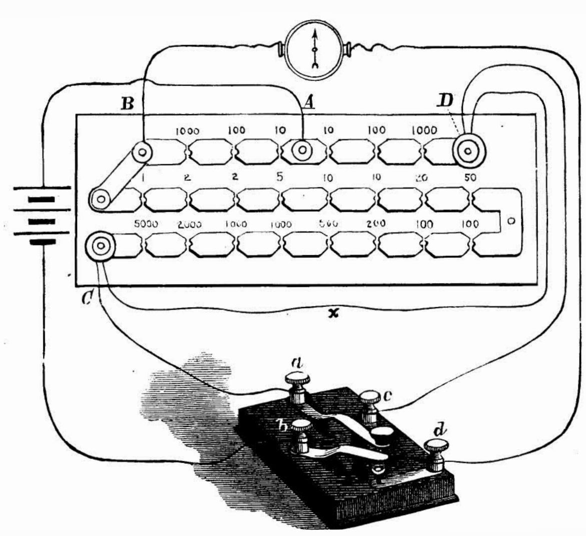


Fig. 5.—BRIDGE KEY AND CONNECTIONS.

bay is lighted by it. That wave lasts you till you get to New Hamburg, or after you round the Dans Kammer, when the Poughkeepsie electric wave is seen, and you hold that for twelve or thirteen miles, or till after you have rounded Crumb Elbow. It all makes a pilot's work much easier than before the electric lights were invented, and if the plants increase north of Poughkeepsie as rapidly as they have south, the Hudson will soon be illuminated nights all the way between New York and Albany."

RECENTLY PATENTED INVENTIONS.

Railway Appliances.

SUPPORT FOR RAILS. — John M. Robbins, Leominster, Mass. Combined with the rails are metallic boxings and wooden stringers having coincident recesses, in connection with which are used metallic ties having hooked end portions that lie in the recesses and embrace the rail flanges, with means for securing the ties to the boxes, making a continuous support for the rails of the track.

STEAM CAR HEATING APPARATUS. — John L. Easley, New York, and Michael H. Whalen, Brooklyn, N. Y. The heater and steam boiler are located at one side of and beneath a car, with heating pipes extending over the floor of the aisle beneath the usual form of grating, the construction being especially adapted for street cars, and being designed to heat them without taking up much room, and with but a small expenditure of fuel.

Engineering.

SMOKE CONSUMING FURNACE.—George W. Wilcox, St. Louis, Mo. This invention relates to steam boiler furnaces in which jets of mingled heated air and steam are projected upon incandescent coal within the fire box, steam being used to induce air currents in the pipes and also to prevent the pipes from burning.

FURNACE. — Alfred Don and John Sands, Sydney, New South Wales. This invention covers an improvement on a former patented invention of the same inventors for apparatus to consume the smoke and for the more perfect combustion of the fuel, providing an air induction pipe projecting into the furnace, having fitted therein a steam pipe, and so constructed that a much increased volume of air may be driven into the furnace, and at a greater velocity.

Agricultural.

HEADER FOR HARVESTERS. — George A. Joy, Bismarck, Dakota Ter. This invention covers an attachment designed to convert any harvester and binder into an economical header, saving the farmer the expense of purchasing two machines, the attachment consisting of a novel construction and combination of parts, with which also the machine can be changed from a low cut as used in binders to a high cut as used in headers, etc.

Miscellaneous.

OIL CAN.—James A. Campbell, New Orleans, La. In this can the nozzle remains closed except when the bottom of the can is pressed, thereby preventing waste of oil between the holes in oiling, while the operator is enabled to see how much oil is given to each hole, and to easily control the quantity, from one drop to a continuous stream, by the pressure of the thumb on the bottom of the can.

NEEDLE GUARD FOR SEWING MACHINES.—James S. Patten, Baltimore, Md. This is a guard for the presser foot consisting of parallel vertically extending plates, connected at the lower ends of their rear edges, and formed on their lower edges with apertured flanges, by the use of which all danger of the operator accidentally getting his or her finger in the path of the needle will be avoided.

SNAP HOOK. — Thomas T. Morrow, Caro, Mich. This is a hook designed especially for use on whiffletrees, vehicle tongues, etc., the support of the hook being preferably made in the shape of a ferrule socketed at one end to facilitate its application, the hook being pivoted in a slot in such support, so that in the closed position of the hook its open end will be closed by the support.

FENCE.—Peter Mast, Waterville, Ohio. This is a wire fence designed to be erected in sections, with a spring tightener of simple construction and readily manipulated, means being provided whereby the center of the several panels may be supported from the ground, the end sections rigidly braced and strengthened, and for uniting the several strands or strips employed in the construction of the fence.

ANIMAL TREAD POWER. — David C. Frazeur and William J. Davis, of New Market, N. J. A track or guide is fixed to a substantial supporting frame, an endless chain of rollers running freely on the track, and an endless chain of lags running freely on the endless chain of rollers, the endless chains of rollers and lags being supported entirely independent of drums or wheels, and the speed of travel of the lags being independent of the speed of travel of the chain of rollers.

PIPE STOPPER.—John W. Chisholm, Liverpool, N. S., Canada. This is a plug or stopper specially designed to close up the end of a pipe, whether the latter has a smooth or a rough inner surface, and consists of a flexible packing ring, with disks adapted to expand the ring when forced together, the disks being pressed together by means of a toggle joint arranged to be operated by a screw rod engaged by a key.

LOCK. — Otto W. Lundholm, Muchachinock, Iowa. Combined with the sliding bolt is a set of swinging tumblers with registering notches, the tumblers when adjusted by the ward slots of the key constituting thrust bars to transmit the strain of the key to the sliding bolt to force the latter back against a spring, the lock being more especially designed for trunks, desk lids, etc.

WEATHER STRIP. — John E. Jones, New York City. This weather strip consists of a combined strip and spring composed of a thin plate of spring metal set into an inclosing space in the edge of the sash or frame, and curved so that the edge of the plate presses against the stile, the device also acting as a friction spring to prevent windows and blinds from rattling and from dropping down of their own weight.

GRATE AND FIREPLACE GUARD. — Eliza E. Bridgers, Wilmington, N. C. This is a cornice and mantel protector, especially designed to protect wood mantels, lambrequins, etc., from heat and smoke, and is adjustable both in its top and side sections to fit any size grate and mantel, to which it can be readily applied so that it will be firmly held.

PAN.—Thomas O. Morton, Brooklyn, N. Y. This is a pan of which the upper edges are stiffened and ornamented by a bead composed of a tube, preferably of brass, slotted and applied to the edges, the ends of the tubes being connected to form the proper finish, and the tubes being held in place by lips or fastening devices at the edge of the pan.

MUSIC HOLDER. — Burdett Guy, Oneonta, N. Y. This holder covers a longitudinally adjustable inclined leaf-holding rod fitted to pass through a rotatable or swiveling head of a post on a music rack, to which it is easily attached, being both simple and ornamental, while it admits of a large range of adjustment.

MUSTACHE GUARD.—May E. Harrington, No. 151 West Fourteenth Street, New York City. This is a guard for attachment to spoons or cups, and has a spring extension in the direction of its length, and means for securing it to the handle, whereby the guard will be supported above the edge of the article to which it is applied, and have a laterally yielding movement.

Business and Personal.

The charge for Insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

NEW BOOKS AND PUBLICATIONS.

ROPP'S COMMERCIAL CALCULATOR. C. Ropp, Bloomington, Ill.

This is a neatly and compactly gotten up ready calculator, business arithmetic, and pocket account book combined, containing many rules for rapid calculation and answers to business examples such as daily come before the farmer, the mechanic, or the business man. It contains numerous "short cuts in figures," and such explanations as will render ordinary calculations easy for those most deficient in education.

Food, its Value, Digestibility, and Composition. A very interesting chart relative to the composition, digestibility, and nutritive value of food has been compiled by Professor Henry A. Mott. A quantity of information under the above heading, of the type most often called for, is judiciously arranged under numerous heads, such as: Relative value of foods, their digestibility, a table of the most easily digested articles, standards for daily dietaries, analyses of many products, etc. Some thirty-seven such heads are employed, and the information given under them is thoroughly reliable, is recent as regards authority, and is well to the point. During the spring of the present year Professor Mott was one of the staff of lecturers in the people's course of free lectures given under the auspices of the Board of Education of New York. Part of the substance of these lectures, with much additional matter, is embodied in this chart. It is mounted for hanging on the wall with roller, in good style for use in the house or school. The publishers are John Wiley & Sons.

Miller's Guides to New England Cities satisfactorily cover a very interesting field, and one which we should think might profitably be very much enlarged. These guides are handsomely gotten up and richly illustrated with fine photogravure views of the most noteworthy objects, as well as portraits of leading citizens and people historically connected with the several localities. These guides are now issued monthly in Hartford, New Haven, Meriden, Bridgeport, and Danbury, Conn., and Worcester, Springfield, Holyoke, and Westfield, Mass., by the C. H. R. Miller Publishing Company.

The American Art Printer, published by C. E. Bartholomew, of No. 22 College Place, New York, always has much in the way of artistic typography to delight the eye and to afford valuable practical instruction to all members of the craft, in the press room as well as the composing room. Some of the novel rule forms in the last number are particularly good.

☞Any of the above books may be purchased through this office. Send for new book catalogue just published.

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Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information, and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all, either by letter or in this department, each must take his turn.

Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.

Scientific American Supplements referred to may be had at the office. Price 10 cents each.

Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

(1388) S. L. T. asks for a receipt for making hair dye from the hull of walnuts? A. *a*. The hulls of green walnuts are pounded up, and the juice expressed by squeezing in a tincture press. The juice is then rubbed up with olive oil. Or *b*, the juice as expressed is used mixed with a little rectified spirits and perfumed with oil of cloves, the latter acting as a preservative. The whole is allowed to stand for a week or two with occasional agitation, and the clear solution is eventually decanted. Sometimes salt is used to preserve it. These dyes stain the skin very strongly.

(1389) J. B. asks: 1. What is the proper acid to use in etching on steel surface, and the degree of strength, or dilution? A. Use nitric acid 1 part, water 3 parts. 2. Is the result of this process sufficiently neat and accurate for forming small letters on steel, that is, are the lines well defined and smooth? A. Yes. The finest engraving is done with acid. 3. What chemicals to use in battery referred to in SUPPLEMENT, No. 641, in connection with the electric motor therein described? A. The battery is described as a bichromate battery, which means a solution of bichromate of potassa in water. 4. How much does it require to charge each cell? A. Cell to be filled nearly to top. 5. Where can the battery be obtained? A. From electric construction and supply companies.

(1390) R. T. H. asks about lead burning, a process of melting lead together lead instead of soldering as commonly done by plumbers, and greatly used in chemical factories where acids are made. Lead burning is effected by placing the clean edges of the lead together and melting them with a fine blowpipe flame, generally of hydrogen gas, so that the edges become joined. The only art in this is the care necessary not to overdo it and cut holes in the lead sheet. Horizontal seams are easily done, but the vertical seams give some trouble, and there is where the art lies. To run a hot iron or blowpipe over a vertical seam and have the lead stay there and make a solid joint is somewhat difficult. To a person wishing to learn we can only suggest a persistent trial or the advice of a plumber who has the art.

(1391) J. F. B.—There is no perceptible difference in the heating value of Lehigh and the best bituminous coal when burned, each under the best arrangement for perfect combustion. In open grates Lehigh coal gives out the most heat, but in furnaces properly fired, the slight difference may vary either way.

(1392) L. G. asks: What is in pounds the amount of pressure required on every brake shoe to stop the rotation of every wheel of freight or passenger car with full load and cause them to slide on the rails? A. About three-fourths of a ton to each ton weight upon the wheels. See an interesting account of brake trials in SCIENTIFIC AMERICAN SUPPLEMENT, No. 697.

(1393) J. K. H.—Boiled linseed oil brushed over the cement will make a good and dustless surface.

(1394) C. A. B. asks: 1. What composition is used to polish wood while in the lathe? A. Shellac varnish and boiled linseed oil, equal parts, shaken before using, or simple friction with a handful of wood turnings. 2. What ink is used in tattooing, and how is it applied? A. India ink pricked in with a needle.

(1395) S. E. K. F. writes: I have made many failures to cast a cane head of coin silver. Either the mould fails to fill or the casting has air holes. A. Use fine loam sand for the mould, as dry as it will work in moulding. Make the cone also of sand a little coarser, wet with a little beer, just enough to make it stick together. Make a hole in the core through the print to ventilate it. Dry it in an oven, and put the metal in the mould hot. The holes were caused by gas blowing out. The core should have a long stem projecting into the sand to balance and hold it.

(1396) Alex asks how many points constitute a game of casino; 21 points, or the player making the most points in one deal of the cards, when but two players oppose each other? A. Twenty-one points generally count as a game, the player first making that number being winner.

(1397) H. R.—Moulds for casting iron can only be made in sand. Iron or other metallic moulds chill the iron, and it does not fill well. The great heat at which iron melts will burn any other material, or will stick so as to break the mould.

(1398) D. R. asks how polishing and beveling plate glass is done. A. The bevels are ground on emery laps or wheels and on grindstones with water, then partially polished with sand and pumice on wooden wheels and finished with a rouge buff.

(1399) G. R. R. asks: For furnishing steam for 50 horse power engine, which will be the safest and most economical, one large or two small boilers, and would more than two flues be advisable in each, using nut and slack coal mixed for fuel? A. We recommend one boiler of 50 horse power, with 3 inch or 3½ inch tubes, as the most economical and safest within reasonable limit as to pressure.

(1400) M. T. N. asks how to tint photographs on the card. A. Wash the surface of the photograph over with a weak solution of oxgall, using for the purpose a camel's hair pencil. The colors, which can be obtained from any dealer in photographic materials, may be put on with a black sable brush.

(1401) E M.—You may have slightly misunderstood the lecturer. It may have been one, two, or more, million of years "since" the fishes now found embedded in rocks were buried in the sediment of the primordial oceans, according to geological evidence.

(1402) H. P. D. V. asks the best method to temper tool steel to make it suitable for permanent magnets. A. Harden the magnet as you would a cutting tool by heating to a cherry red and dipping in water. Then brighten the surface and heat evenly until it turns to a light blue, then quickly cool in water.

(1403) W. H.—There is no way of softening wood without injuring its strength. There is nothing used by wood benders to soften the wood but steam or hot water. If the wood can be steamed under a slight pressure, so that it will be fully up to 212° when bent, it makes better bends. Where large quantities of the same pattern are to be bent, a machine is used to save splintering.

(1404) H. S. H. asks: 1. Would it be possible, by means of the stereopticon, to enlarge from Kodak negatives on bromide paper in the following manner: By taking out the ordinary illuminating apparatus, and reflecting bright sunlight through the condensers by means of an eight or ten inch mirror. A. Yes; but instead of sunlight use light from the north sky. 2. The instrument in question has 3½ inch condensers and one of Queen's double achromatic objectives 1¾ inch in diameter. If this can be done, about how long should the paper be exposed? A. The time depends greatly on the size of the enlargement. If the negative is to be enlarged twice the size, try one minute exposure. If the image develops too slow, then you will know that the exposure should have been longer. Address the Eastman Dry Plate and Film Company, Rochester, N. Y., who will give you a practical treatise on the subject.

(1405) B. P.—See SCIENTIFIC AMERICAN SUPPLEMENT, No. 34, for a plan of a bath for tinning or galvanizing wire.

(1406) D. McC.—The magnetic needle points in the same direction as to the magnetic poles in all parts of the earth. The magnetic poles do not correspond with the axis of the earth, which makes a variation of the needle at places not on a meridian which coincides with both poles. The needle is never inverted, but dips as it approaches the magnetic poles.

(1407) J. B. B. asks for a receipt to polish agate stones. A. Work on the lines indicated in our SUPPLEMENT, No. 318, in which lens grinding is described. By following the directions there given you will attain the best possible results.

(1408) W. H. B. asks: Why is it that albumen prints toned in the same bath vary in color from brown to black? A. Possibly because there is not gold enough in the bath or that the paper is old and of the ready sensitized kind. Generally it is advisable to keep the prints in the bath until the desired color appears in the print when viewed by transmitted light. The gold must penetrate fully into the film to make an unchangeable color, and the bath must be alkaline.

(1409) B. S. Co. write: We have been trying to make a contract for new boilers, but find that there is a great difference of opinion among the makers of boilers as to the manner of estimating the horse power. We want to get two boilers of 80 horse power each. One firm has submitted the following specification, claiming that the boilers will be about what we want, but are not willing to guarantee a specified horse power. The boilers are to be after the style of locomotive boilers, of the following dimensions: Height in front 7 feet, length 20 feet, diameter 48 inches. Fire box: Outside 6 feet, inside 5½ feet. Dome: Diameter 30 inches, height 30 inches. Flues: Number 53, diameter 3 inches, length 12 feet. Stacks: Diameter 30 inches, height 30 feet. What power should these boilers develop? A. The nominal horse power of boilers is rated by the number of square feet of heating surface, 12 square feet being rated at 1 horse power, except in very large boilers, in which 10 square feet is so rated. This is after making an allowance of loss of effective surface in the tubes of one-third their total surface. Some makers rate the gross surface at 12 square feet to a horse power. With the latter allowance your proposed boilers would rate at 45 horse power; allowing 10 feet, the boilers would rate at 53 horse power, or two-thirds what you require.

(1410) F. A. writes: I have just completed an electric motor as described in your valuable paper of March 17, 1888, and have met with excellent results. I have placed the motor in a boat 13 feet by 3 feet beam, which it drives at a fair speed. The battery consists of twelve ½ gallon cells, with zincs and carbons 4 x 6, arranged in series. I wish to make another motor, but I want to increase the power to 2 horse power, to drive a boat 25 feet long. Now will you be kind enough to let me know what changes I should make to get the required power, the size, number of copper wire, number of cells required to run same, and should I maintain the same number of convolutions in the different coils as in the small motor, and can I increase the number of coils on the armature without detriment to the motor, as I wish to put on as many as the ring will carry? Also would it affect the motor any by placing the soft iron core of armature on a cast iron pulley (instead of wooden hub), as I wish to tighten armature to steel shaft by a set screw, wrapping the coils around so as to inclose the cast iron pulley as well as the wire ring, they being insulated from each other by adhesive tape, or would it do to have ring made of soft cast iron as shown in diagram No. 12? How can I find the voltage of a battery, and what books do you recommend on electricity, and have you any for sale? A. We do not think it advisable to run a 2 horse power electric motor by means of a primary battery. The expense and trouble of running it will be considerable. Should you desire to construct such a motor, we advise you to copy one of the existing motors of approved form. By enlarging the dimensions of the small motor 2½ or 3 times linear, you will approximate the proper proportions. You should divide the armature into 36 or 40 coils, using No. 14 wire for the armature and No. 18 for the field magnet; connect as a shunt machine. You will probably need at least 20 cells of battery. It is not advisable to use cast iron in the armature core. You can find the voltage of a battery by comparing it with a Daniell's cell by the aid of a tangent galvanometer. We refer you to "Experimental Science," by George M. Hopkins, Munn & Co. publishers, New York, by mail $4; "Practical Electricity," by Ayrton, price $2.50; "Electrical Measurements," by Lockwood, price $1.50.

(1411) H. J. S. writes: 1. I have a small button of gold that contains copper, silver, lead, and platinum; how can I successfully treat the chemicals so as to have separately fine gold, silver, and platinum, the cheapest and quickest way? A. Fuse the button with twice its weight of silver, hammer or roll out thin, and treat with nitric acid. This dissolves the silver, which can be precipitated as chloride by addition of hydrochloric acid, and can be reduced by zinc and fused on charcoal. The undissolved gold and platinum are dissolved in aqua regia (1 part nitric and 2 parts hydrochloric acid), and the platinum is precipitated by addition of ammonium chloride in solution, and alcohol 2 volumes. The precipitate is filtered out and ignited, giving metallic platinum. The filtrate is boiled down with more hydrochloric acid until concentrated, and solution of ferrous sulphate added. This precipitates metallic gold. 2. In bending small gold tubing (12 to 15 round gauge) I have used brass or copper as a filling to prevent the tubing flattening or kinking, and have used nitric acid to take out the filling after bending. What can I use that will answer the same purpose as the brass or copper, so that I will not have to use acid, and that can be quickly put into and taken out of the tubing? A. Use a fusible alloy such as the following:

Lead	25 parts.
Cadmium	13 "
Bismuth	50 "
Tin	12 "

Melt under water and use at a low temperature. The gold tube may be warmed in warm water to make the alloy run well. This composition melts at about 160° Fah.

(1412) J. A. McN. writes: I have ten plates of carbon, each 12×3, and zinc same size. What will be the better battery to construct for general experiments? A. Make the plunging battery with two plates of carbon to each plate of zinc. 2. Is the chromic acid solution superior to the bichromate of potash? A. Yes. A bichromate of soda solution is also very good. 3. What will be about the voltage of each of the batteries? A. About 2 volts. 4. Which will give the better effect, 4 four-candle lamps or 2 eight-candle lamps, and how long should the batteries sustain them? A. You will probably succeed better with the four-candle lamps. The battery probably will not run longer than four hours. 5. Which SUPPLEMENT contains instructions for making a cheap galvanometer? A. You can make a galvanometer by placing a flat coil of wire under a compass. Such an instrument is valuable only for rough work. See SUPPLEMENT, No. 628, for a very delicate galvanometer.

(1413) D. G. Eaton asks: Would it be possible to send an alternating current of 1,000 alternations per second over a long circuit? If possible, would such a current be likely to develop any phenomena in the way of static charge, retardation, etc., different from what might be expected from a constant current under like conditions? A. There is no more difficulty in sending alternating currents over a long line than would be experienced in sending a direct current. As the alternating currents would produce equal and opposite effects, they would neutralize each other, and that no peculiar phenomena would be developed.

(1414) W. P. B. asks: Will you inform me through your paper if ten coils on armature of simple electric motor will answer as well as twelve? I wound the ring with No. 16 double-covered wire, and could not get but eleven coils on. If it will run with ten, should the field magnets be wound the same as if it had twelve? A. The more cells you can get on the armature core, the better. Your motor will probably run with 10 coils; 12, 14, or 16 would be more satisfactory. The winding of the field magnet may remain the same.

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October 1, 1889,

AND EACH BEARING THAT DATE.

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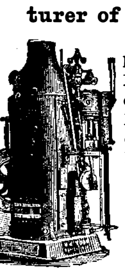

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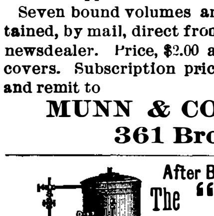

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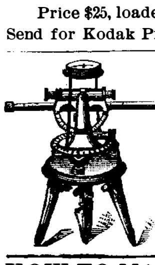

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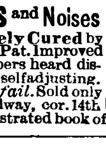

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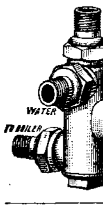

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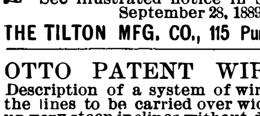

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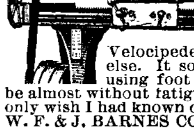

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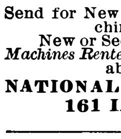

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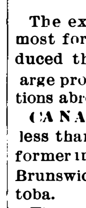
JOHN WANAMAKER, *Postmaster General.*



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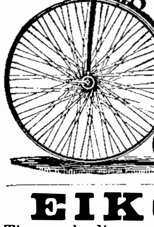

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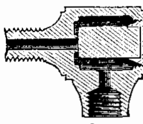

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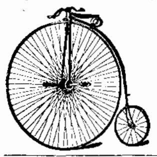

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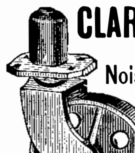

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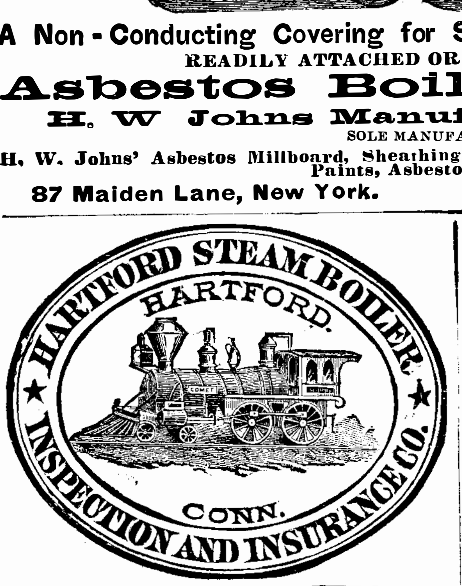

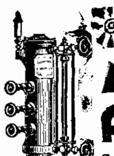

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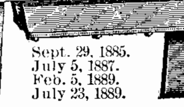

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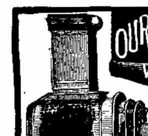

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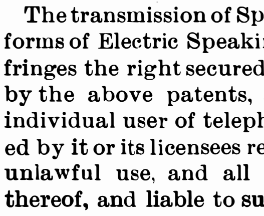

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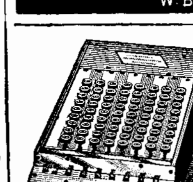

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